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'Knowledge is proud that he has learned so much;
Wisdom is humble that he knows no more.'—COWPER.

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Honours Hygiene.

BY

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VENTILATION.

THE temperature of a given atmosphere is a most important factor in determining the ease with which it is replenished from the external air. Speaking generally, the greater the difference between the temperature of two masses of air the more rapidly an interchange occurs.

Air has weight. A column of it one inch square and extending to the uppermost limit of the atmosphere weighs about 14·6 lbs., and exerts this pressure on all substances at the surface of the earth. This pressure is exerted uniformly in all directions; but for this fact our chests would be crushed in by the external pressure on them, which amounts to over four tons. If the atmospheric pressure is diminished at any point, it is evident that the surrounding air will tend to press in this direction. Now, when air is heated it expands, and consequently the heavier fresh air flows in from all sides and pushes the lighter air upwards.

The expansion of air for every increase of 1° Cent. is ·003665 ($\frac{1}{273}$), for every increase of 1° Fahr. is ·00203 ($\frac{1}{491}$). Thus if the air in a room is 20° F. warmer than that outside, it will be expanded to $\frac{1}{25}$ additional bulk.

Thus if M = volume of a given air at 32°, with the barometer at 30 inches, and

M_1 = volume at temperature $t°$ above 32°, while a = coefficient of expansion for each degree of elevation of temperature, then dilatation by heat will be expressed by the formula—

$$M_1 = M\ (1 + at).$$

When the temperature is decreasing,

$$M_1 = M\ (1 - at).$$

If the air in a chimney flue is cooler than the air of the room with which it communicates, it will flow down into the room. It is the object of an economical fireplace to cause the chimney to act as an outlet for the products of combustion and for the impurities of the air of the room with the smallest possible waste of heat. Short of producing a down draught of cold air and smoke, the smaller the difference between the temperature of the air of a room and of the air escaping near the top of the chimney, the greater the economy of the fire.

The movement of air in flues and other outlets is governed by general laws, like those governing the general movements of fluids. Allowances require to be made for friction in the channels of entrance and outlet which will be subsequently considered.

The theoretical velocity, when friction is not taken into account, may be calculated by a formula based on what is known as the *law of Montgolfier*, or the law of spouting fluids. According to this law, fluids pass through an opening in a partition with the same velocity as a body would attain in falling through a height equal to the difference in depth of the fluid on the two sides of the partition, *i.e.*, to the difference of pressure on the two sides. Thus, if AB equals the height of a column of air at say 50° F., and AC is the height of the same quantity of air heated to 60°, then the velocity at which the warmer air ascends will be that which a body would acquire in falling from C to B.

Now the velocity in feet per second of falling bodies is about eight times the square root of the height from which they have fallen; and the formula for determining this is—

$$v = c\sqrt{2gh} = 8c\sqrt{h}.$$

In this formula v = required velocity in feet per second:

g = 32·17 feet per second:

h = distance fallen through by the body:

c = a constant determined by experiment, and expressing the proportion of the actual to the theoretical velocity.

Adapting this formula to the special circumstances under which Montgolfier's formula holds, we find that the force which drives the warm air up the flue is the force of gravity, *i.e.*, of the excess of the weight of a column of cold air over the weight of a column of warm air of exactly the same size (represented by BC in the above diagram). The difference of the two weights or pressures is found by multiplying the distance from the point of escape of heated air from the room (fireplace or elsewhere) to the point of escape into the outer air (top of chimney or other point of exit), by the difference in temperature inside and outside, and again multiplying this product by $\frac{1}{491}$ for degrees of Fahrenheit temperature, or $\frac{1}{273}$ for degrees Centigrade.

Thus omitting c for the present, we have

$$v = \sqrt{\frac{2gh(t - t^1)}{491}} = 8{\cdot}2\sqrt{\frac{h(t - t^1)}{491}}$$

Where t = temperature in the chimney,
t^1 = temperature of the external air, and
h = height of chimney.

Example 7.—The chief means of ventilating a given room is by its open fireplace. The temperature in the chimney is 100° F., that of the external air 40°, and the height of the chimney 50 feet; what is the velocity with which air is leaving the room?

$$v = 8{\cdot}2\sqrt{\frac{(100 - 40) \times 50}{491}}$$
$$= \underline{20.}$$

This gives the theoretical velocity, but the real velocity will differ from the theoretical by an amount varying from 20 to 50 per cent.

It will be evident from what has been said, that the movements of the air in a confined space are dependent upon (1), the difference between the internal and external temperatures; (2), the area and friction at the apertures through which air enters and leaves the room; and (3), the height of the column of ascending warm air. The higher the chimney (assuming it to contain warmed air), the greater the draught and the more efficient the ventilation of the room communicating with it.

ALLOWANCE FOR FRICTION.

Practically the friction varies greatly according to the size, form, and material of outlet for air. A rough or sooty or angular chimney greatly impedes the outgoing current of air.

It is usual to reduce the theoretical velocity by 20 to 50 per cent. Apart from the friction which is governed by roughness and length of channels, that due to bends in the channel may be calculated by the formula $\frac{1}{1 + sin^2\theta}$, θ being the angle at any bend in the channel.

(It may be convenient to note that

$sin^2 90° = 1$, $sin^2 60° = \frac{3}{4}$
$sin^2 45° = \frac{1}{2}$, $sin^2 30° = \frac{1}{4}$.)

Thus every right angle in a bent shaft reduces the velocity in it by one-half.

The loss by friction in two similar tubes of equal sectional area varies (1) directly with the square of the velocity of the air currents; and (2) directly with the length of the outlet channel. In two similar tubes of unequal size the loss by friction is (3) inversely as the diameter of the cross section in each.

When two tubes are of different shapes, the loss by friction is inversely as the square roots of the sectional areas.

Owing to the variable value of the coefficient of friction (called c in first formula given), it is usually preferable to measure the actual rate of progress of air through a given flue by means of an anemometer (wind measurer). Then having given the velocity of the current of air and the area of the cross-section of the flue, the volume of air discharged in a given time is represented by the product of these two and the time which has elapsed.

Thus, $q = a \times v$.

Where q = quantity of air discharged in a given time, a = area of flue, v = velocity of current.

By means of this formula, the area of chimney required to discharge a given volume of air at a given average velocity can be ascertained. Thus,

$$a = \frac{q.}{v.}$$

The application of the preceding principles and formulæ will be rendered clearer by the following examples.

Example 8.—How much inlet and outlet area per head will be required to give 10 persons in a room of 5000 cubic feet capacity, 2000 cubic feet of air per head per hour, supposing that the outside temperature is 40°, while the internal temperature is 60°, and the height of the heated column of air 20 feet?

First ascertain the velocity of entrance and exit of air.

$$v = 8{\cdot}2\sqrt{\frac{h(t - t^1)}{491}}$$
$$= 8{\cdot}2\sqrt{\frac{20(60 - 40)}{491}} = 8{\cdot}2 \times {\cdot}903$$
$$= 7{\cdot}3964 = \text{velocity in feet per second.}$$

If we allow one fourth for friction then there remains a velocity of 5·5473 feet per second.

5·5473 feet per second = 19700·8 feet per hour.

Now, $a = \frac{q.}{v.}$

$$= \frac{2000}{19700{\cdot}8} = {\cdot}1015 \text{ square feet}$$
$$= \underline{14{\cdot}6 \text{ square inches.}}$$

Thus the size of the outlet required per head is 14·6 square inches. The size of the room and the number occupying it do not enter into the question, except for a short time at the beginning; during which it might be assumed that, as there are 5,000 cubic feet of air in the room, no inlets or exits will be required, until this is brought down to the allowable limit of impurity (6 parts of carbonic acid in 10,000 of air).

The amount of inlet required will also be 14·6 square inches per head. Theoretically it ought to be slightly less than that required for outlet, as the outgoing air is more expanded than that entering the room; but practically no allowance need be made for this fact.

The total amount of inlet and outlet required per head = 29·2 square inches.

Example 9.—If the mean temperature of a room is 61°, the external temperature 45°, while the heated column of air is 50 feet, and the required delivery of air 2000 cubic feet per hour, find the size of inlet and outlet.

$$v = 8{\cdot}2\sqrt{\frac{h\,(t - t^1)}{491}}$$

$$= 8{\cdot}2\sqrt{\frac{50\,(61 - 45)}{491}}$$

= 10·55 feet per second.

= 37980 feet per hour.

If we make no allowance for friction, then

$$a = \frac{q.}{v.}$$

$$= \frac{2000}{37980} \text{ square feet.}$$

$$= \frac{2000 \times 144}{37980} = 7{\cdot}58 \text{ square inches.}$$

This gives the required size of outlet. The size of inlet and outlet together = 15·16 square inches.

Example 10.—If 3,000 cubic feet of air are supplied in one hour through an aperture of 12 square inches to a room containing 1,000 cubic feet of space, at what rate does the air enter the room?

12 square inches = $\frac{1}{12}$ square foot.

$$a = \frac{q.}{v.}$$

$$\frac{1}{12} = \frac{3000}{v}$$

Therefore v = 36000 feet per hour.

= 10 feet per second.

Example 11.—If a room is supplied with 3000 cubic feet of air per hour, through a single opening, what must be its area, if the rate of movement of the air is 5 feet per second?

5 feet per second = 18,000 feet per hour.

$$a = \frac{3000}{18000} = \frac{1}{6} \text{ square foot.}$$

= 24 square inches.

The difficulties connected with the estimation of amount of friction greatly detract from the practical value of the formulæ just given. It has been found necessary to make actual measurements of the velocity of air-currents by means of an anemometer. The results given by anemometers are not always trustworthy, but by comparing the results given by them with the results obtained by the use of Montgolfier's formula an approximate result can be obtained. The ordinary anemometer consists of four tiny vanes fixed to a spindle, so that revolutions are caused by the current of air the velocity of which is to be measured. The revolutions are counted by a mechanical arrangement. The value of the revolutions of the vanes has to be first determined by direct experiment; a known bulk of air being forced through a channel of known size at a uniform rate, and the instrument graduated accordingly. In Fletcher's anemometer a modification of the manometer or pressure-gauge has been used for the same purpose.

(To be continued.)

Contracted Arithmetic.

BY J. I. RICHARDSON.

SECTION IV.

Subtraction.

The process of subtraction would be more simple, accurate, and expeditious were the following plan uniformly adopted:—

When the quantity to be subtracted exceeds the minuend, and 'borrowing' becomes necessary, take the subtrahend first from the quantity borrowed, and to the remainder add the minuend. As an example of simple subtraction, suppose 347 to be deducted from 532. Instead of saying 'seven from two we cannot, borrow ten; ten and two are twelve; seven from twelve leaves five,' we should say 'seven from two we cannot; seven from ten leaves three; three and two are five.' One is carried as usual to the next lower figure which thus becomes five. Then five from ten leaves five, which with the upper three makes eight to put down.

The method is even more useful in money, weights and measures, and it is well at first to place above each term its index for conversion into the next higher denomination, as 4 over farthings, 20 over shillings, 10 over pounds and ordinary digits, and so on. Whether or not the subtrahend can be taken from the minuend may be seen at a glance. If it cannot, it should be taken from the index above, and the minuend added to the remainder. With practice the habit of doing this becomes instantaneous, and the results almost invariably accurate.

EXERCISE VI.

Simple Subtraction.

1.	2.	3.	4.	5.	6.	7.
384	782	502	627	345	5,826	9,204
295	496	443	198	276	3,949	2,678

8.	9.	10.	11.	12.
7,213	3,254	3,456	245,678	340,117
4,987	1,867	987	146,793	165,439

13.	14.	15.	16.
562,173	512,563	79,234,563	50,120,345
379,865	456,789	67,489,754	23,456,789

17.	18.	19.	20.
77,324,150	34,512,345	31,031,031	43,762,410
18,468,249	25,498,765	30,945,678	37,386,549

EXERCISE VII.

Compound Subtraction.

1.			2.			3.		
£	s.	d.	£	s.	d.	£	s.	d.
3	18	6½	12	16	7½	16	15	5
2	19	7½	10	18	9¾	14	16	9¾

4.			5.			6.		
£	s.	d.	£	s.	d.	£	s.	d.
78	10	10¼	782	13	0¾	467	14	2¼
39	14	11¼	395	19	10¼	269	18	7¼

7.

£	s.	d.
509	11	2
288	15	4½

8.

£	s.	d.
705	16	10¼
186	18	11¾

9.

£	s.	d.
9,102	15	8
2,987	18	10¼

10.

T.	c.	qr.	lb.	oz.
3	16	2	14	12
2	18	3	15	13

11.

T.	c.	qr.	lb.	oz.
9	13	1	11	11
6	17	3	15	12

12.

m.	fur.	po.	yd.	ft.	in.
8	6	36	4	2	7
2	7	38	4	2	9

13.

m.	f.	po.	yd.	ft.	in.
12	5	13	0	1	2
10	6	20	1	2	8

14.

a.	ro.	per.	sq. yd.	sq. ft.	sq. in.
5	2	38	16	4	137
2	3	39	27¼	6	140

15.

a.	ro.	per.	sq. yd.	sq. ft.	sq. in.
12	1	30	26½	7	100
6	3	33	28	8	120

16.

qrs.	bus.	pks.	gal.	qt.	pts.
4	6	2	1	2	0
2	7	2	1	3	1

17.

qrs.	bus.	pks.	gal.	qts.	pts.
2	4	1	0	1	1
1	6	3	1	1	0

18.

yrs.	mo.	wks.	dys.	hrs.	min.	sec.
8	2	3	4	20	50	49
1	10	3	6	22	57	58

19.

yrs.	mo.	wks.	dys.	hrs.	min.	sec.
50	10	1	2	17	36	50
48	11	3	4	20	41	52

20.

cent.	yrs.	wks.	dys.
527	97	48	2
349	98	50	6

SECTION V.

Subtraction of Two-digit Numbers.

In subtracting two-digit numbers add to each such a quantity as will bring *one* of them up to the next higher group of tens. Then subtract.

Example:—75—38.—By adding 2 to the units digit of both quantities 75 becomes 77, and 38 becomes 40. It is then easy to see that 40 from 77 leaves 37, which is also the difference between 75 and 38.

EXERCISE VIII.

1. 34—19.	2. 58—26.	3. 85—47.	4. 92—86.
5. 81—76.	6. 98—79.	7. 78—29.	8. 62—58.
9. 53—27.	10. 62—35.	11. 84—68.	12. 75—46.
13. 84—76.	14. 25—18.	15. 91—89.	16. 64—47.
17. 90—73.	18. 63—24.	19. 54—39.	20. 85—79.

SECTION VI.

Multiplication by 10, 100, 1,000, &c.

Any number multiplied by 10 will be found to consist of the same figures with the addition of a cypher on the right. If multiplied by 100 or 1,000 there will be two or three cyphers respectively beyond the original digits. Hence the rule for multiplying by 10, 100, 1,000, &c., is to simply annex to the right of the multiplicand as many cyphers as there are in the multiplier.

Example:—54 × 10 = 540. 763 × 1,000 = 763,000

EXERCISE IX.

By 10: 1. 578. 2. 237. 3. 6,892. 4. 5,847. 5. 3,689. 6. 54,921.

By 100: 7. 244. 8. 6,804. 9. 3,827. 10. 6,938. 11. 4,789. 12. 96,241.

By 1,000: 13. 5,672. 14. 3,917. 15. 48,915. 16. 62,486. 17. 9,041. 18. 82,137.

SECTION VII.

Multiplication by any digit followed by Cyphers.

When the multiplier consists of such numbers as 30, 500, 6,000, &c., we multiply by the significant digit, and annex to the result as many cyphers as are in the multiplier. In the example 542 × 400, we find that 542 × 4 = 2,168, which, with two cyphers attached, becomes 216,800.

EXERCISE X.

1. 3,846 × 200.	2. 3,825 × 300.
3. 4,796 × 400.	4. 6,048 × 500.
5. 58,762 × 600.	6. 9,123 × 700.
7. 81,476 × 800.	8. 2,356 × 900.
9. 54,823 × 1,100.	10. 4,587 × 1,200.

SECTION VIII.

Multipliers containing 11 or 12.

When such numbers as 11 or 12 appear in the multiplier, take the two digits as one, and give the result in one line.

Example:—347 × 127. We here multiply first by 7, and then by 12, saving a line of figures.

EXERCISE XI.

1. 3,824 × 119.	2. 4,381 × 114.
3. 7,862 × 115.	4. 3,842 × 116.
5. 2,976 × 117.	6. 396 × 125.
7. 4,723 × 127.	8. 5,829 × 129.
9. 4,671 × 124.	10. 59,214 × 126

ANSWERS.

EXERCISE V.

1. 3,978.	2. 5,420.	3. 5,294.	4. 4,997.
5. 5,440.	6. 6,317.	7. 5,377.	8. 4,788.
9. 5,340.	10. 5,099.	11. 64,831.	12. 85,723.
13. 67,762.	14. 81,994.	15. 14,765.	16. 24,994.
17. 24,913.	18. 21,104.	19. 18,159.	20. 11,547.

EXERCISE VI.

1. 89.	2. 286.	3. 59.	4. 429.
5. 69.	6. 1,877.	7. 6,526.	8. 2,226.
9. 1,387.	10. 2,469.	11. 98,885.	12. 174,678.
13. 182,308.	14. 55,774.	15. 11,744,809.	16. 26,663,556.
17. 53,855,901.	18. 9,013,580.	19. 85,353.	20. 6,375,861.

EXERCISE VII.

1. £0 18s. 10¾d.	2. £1 17s. 9¾d.
3. £1 18s. 7¼d.	4. £38 15s. 10½d.
5. £386 13s. 1¾d.	6. £197 15s. 6½d.
7. £220 15s. 9½d.	8. £518 17s. 10½d.
9. £6,114 16s. 9¾d.	10. 17cwt. 2qr. 26lbs. 15oz.
11. 2 tons 15c. 1qr. 23lbs. 15oz.	12. 5m. 6f. 37po. 4½ yds. 2ft. 10in.
13. 1m. 6fur. 32po. 3½ yds. 1ft. 6in.	14. 2a. 2ro. 38per. 18sq. yds. 6sq. ft. 141 sq. in.
15. 5a. 1r. 36per. 27¾ sq. yds. 7 sq. ft. 124 sq. in.	16. 1qr. 6bus. 3pks. 1gal. 2qrts. 1pt.
17. 5bus. 1pk. 1gal. 0qt. 1pt.	18. 6yrs. 3mo. 3wks. 4dys. 21hrs. 52m. 51s.
19. 1yr. 10m. 1wk. 4dys. 20hrs. 54m. 58s.	20. 177 cent. 98 yrs. 49 wks. 3 days.

EXERCISE VIII.

1. 15.	2. 32.	3. 38.	4. 6.	5. 5.
6. 19.	7. 49.	8. 4.	9. 26.	10. 27.
11. 16.	12. 29.	13. 8.	14. 7.	15. 2.
16. 17.	17. 17.	18. 39.	19. 15.	20. 6.

EXERCISE IX.

1. 5,780.	2. 2,370.	3. 68,920.
4. 58,470.	5. 36,890.	6. 549,210.
7. 24,400.	8. 680,400.	9. 382,700.
10. 693,800.	11. 478,900.	12. 9,624,100.
13. 5,672,000.	14. 3,917,000.	15. 48,915,000.
16. 62,486,000.	17. 9,041,000.	18. 82,137,000.

EXERCISE X.

1. 769,200.	2. 1,147,500.	3. 1,918,400.
4. 3,024,000.	5. 35,257,200.	6. 6,386,100.
7. 65,180,800.	8. 2,120,400.	9. 60,305,300.
10. 5,504,400.		

EXERCISE XI.

1. 455,056.	2. 499,434.	3. 904,130.
4. 445,672.	5. 348,192.	6. 49,500.
7. 599,821.	8. 751,941.	9. 579,204.
10. 7,460,964.		

(To be continued.)

An Elementary Course in the Use of Wood Working Tools.

BY FRED. WILKINSON, F.G.S.,
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IN our last we went over two Exercises dealing with the splitting of wood. We have next to show how the knife is applied in the cutting of wood. When the cutting edge of a tool takes a thin shaving of the surface away it is said to be cutting. Now, cutting tools are divided into two classes, naked and closed. In the former we have the cutting edge bare and not protected in any way, as the chisel, gauge and axe.

The planes are examples of the second class, where the cutting edge is protected somewhat, and the tool which cuts is fixed.

The knife is the simplest form of cutting tool, and cutting tools in general are but developments of it. A dull knife cuts, but not with that ease and finish that a sharp one does.

Crushing and tearing of fibres are the direct results of dull tools.

It will be remembered that we have already pointed out the wedge-like form of the knife (fig. 3 *b*). In cutting, therefore, the shaving, say, is easily forced on one side by the action of this wedge. After performing Exercise III. it will be seen why the shavings are curl-like in form. When we wish to cut with the grain, without splitting, we must not allow the cutting tool, whatever it may be, to enter the wood too deeply. As a result of the inability of the shaving made to escape, splitting is almost inevitable.

Exercise III.

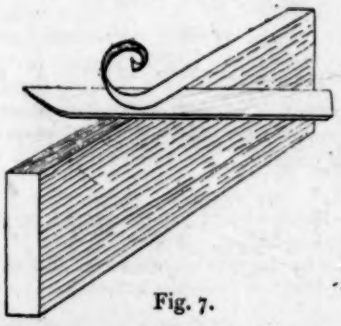


Fig. 7.

To take a shaving from a piece of wood without tearing or splitting it:—

Obtain the wood used in Exercise I., insert the cutting edge of the knife near the end (fig. 7), keep the blade perfectly horizontal, and, applying gentle pressure, move the cutting edge towards the other end. Make the shaving thin, and it will coil over as shown in the diagram. Cut through to the end. Take up the shaving and observe edge. You will notice it varies in thickness. This is the result of unequal pressure exerted in passing from one end to the other.

Exercise IV.

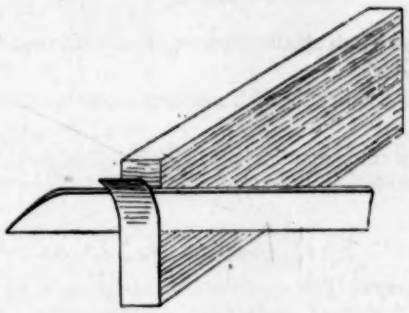


Fig. 8.

Take the same piece of wood, and from the end cut a shaving as in fig. 8.

It will be observed that more pressure is required to cut *across* the grain in this exercise than *with* the grain in the last exercise.

Notice, too, that the thin shaving coils, but not so much as before, and it is more liable to break away.

Before we speak of *Compression cutting* or pressure cutting, we must say a word or two about *Density*, and how the cutting of timber is affected by it.

By the density of wood we mean the relative weight of a volume of wood compared with an equal volume of distilled water at 4° C.

A piece of wood, say oak, is thrown into water. It floats. A piece of iron, if thus thrown, would immediately sink. The former floats because its density is less than water: the latter sinks because its density is greater. Now throw a piece of iron into a dish containing mercury. It floats simply because its density is less than that of mercury.

We next give a list of common woods and their densities. Water must be reckoned as 1·000:—

Beech	·852
Oak	·845
Elm	·800
Yellow Pine	·657
Common Poplar ...	·389
Cork	·240

It will now be readily seen that according to the density of a wood, we shall have to apply greater or less pressure to cut it.

Thus to cut a nick across a lath of beech it will require something like twice the pressure that is required to nick a lath of common poplar.

Exercise V.

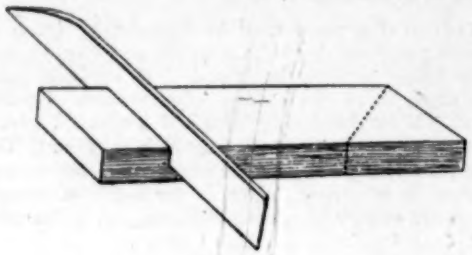


Fig. 9.

Take a lath about 1 ft. long, 1 in. wide, and about ¼ in. thick.

Lay it on the bench and cut across as shown in fig. 9.

Now cut across the lath as indicated by dotted line. Notice the lath has a tendency to split in this exercise.

SECTION II.

STRIKING TOOLS.—We next come to a very important class of tools called *striking tools*. These may be divided into two classes. We have, first, those that act directly, as the axe and hatchet. These, in addition to being striking tools, are also cutting tools. The second class includes those that act on some other body first, and not on the wood. We have examples in the hammer and mallet.

In using striking tools three distinct motions are practised:

The shoulder motion.

The elbow motion.

The wrist motion.

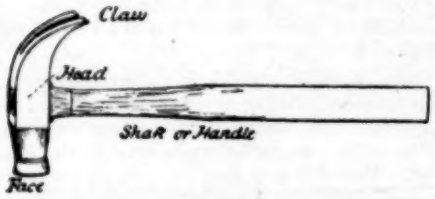


Fig. 10.

SECOND TOOL: THE HAMMER.—Fig. 10 shows an ordinary hammer used by carpenters and joiners. It consists of two parts: the head and shaft, or handle. The former is generally made of steel. The face is sometimes hardened, in order that it may not be injured when it strikes very hard bodies. It will be readily seen that if the face is brought in contact with a body of greater density than itself, it will suffer, and ugly marks on the face will be the result. The open part of the head behind goes by the name of claw, and is extremely useful in withdrawing nails and other bodies. Hammers vary in weight from 6 to 18 ounces.

In striking with the hammer grip it firmly, allowing the thumb to rest upon the first and second fingers.

The higher the hammer is raised above the point to which the face must be applied the heavier will be the resulting blow. As nails vary in length and thickness it is clear they will require blows varying in force to drive them completely into wood.

Exercise VI.

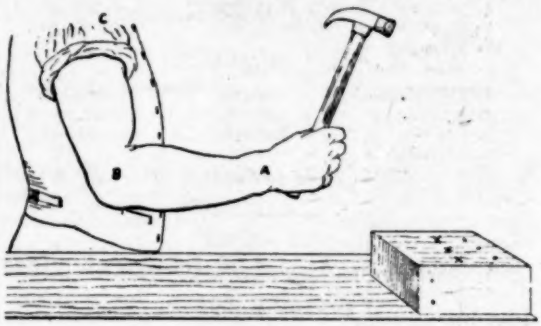


Fig. 11.

Take three tacks, ½ in. Place a piece of soft wood about 6 in. × 4 in. × 2 in. on the bench. Take the hammer in right hand firmly, as shown in fig. 11. With a light tap fix the tacks as shown by the dots nearest the edge. When this has been done, by simple wrist movement drive them into the wood. Keep the arm perfectly horizontal, and do not allow it to move at all. Let A act as a pivot.

Exercise VII.

Into the same piece of wood drive 3 nails (wire), 1½ in. long. We now find greater force is required. Then the arm up to elbow must be lifted, and the point B must act as a pivot this time (see fig. 11). Fix the nails as before, and then by elbow movement drive them in. Their position is indicated by three crosses.

Exercise VIII.

Now turn the wood on to its side and drive two 3-in. nails in. This time we employ the shoulder motion. The position of nails is indicated by two dots on the side (fig. 11). The nails are easily driven in if this movement be adopted. Remember always to give steady blows, having the hammer firmly grasped, and let the face of the head be horizontal when alighting on the head of the nails. This will ensure the nail being driven into the wood true.

SECTION III.

THIRD TOOL: PLANE.—Truing or planing a surface. As the pupil will frequently be called upon to produce true or plane surfaces, it is advisable to allow him to become proficient in this particular work as early as possible. We propose to take the plane next.

N.B.—Pupils should not on any account tamper with the plane as yet. The plane will be taken to pieces later by the pupils themselves and set up again by them.

The jack plane, on account of its frequent use and general durability, demands a premier position, and we take it first.

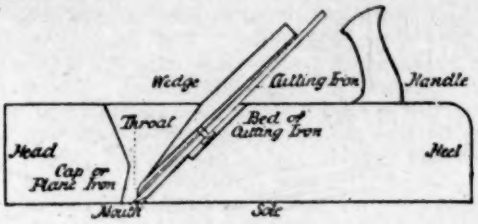


Fig. 12.

Fig. 12 shows a jack plane in section. Its general length is from 12 in. to 14 in. It is specially adapted for cutting heavy shavings, and is suited to heavy work. In addition, it can be held firmly and easily.

It consists of four main parts, viz. :—

The stock.
The cutting tool, or iron.
The plane iron, or 'cap.'
The wedge.

The stock holds the latter three. The second and third are fastened together by a screw, as we shall explain later on; and these two are in turn firmly fixed in the bed of the plane by the wedge.

The other parts to be noticed are: the head, heel, throat, mouth, sole, and handle.

(To be continued.)

How a Scotch School was Examined.

INFANT DEPARTMENT.

On entering the Infant Room the Inspector requested the Teachers to take charge of the classes and go on with the work as shewn on the Time Table. During the lessons he went from one class to another, but did not interfere with the management. He did not ask a single question but left everything to the Mistress. The Class Books were—Collin's Primer I, Nelson's The Little Reader, Part I, and The Royal Reader, Part I.

STANDARDS I.—VI.

Reading books—Star Reader and Blackwood's Educational Series for all Standards.

Geography and History for Standards III.—VI. Chambers' Combined.

STANDARD I.

Some read and some wrote. Spelling was taken from the words at the end of the lesson.

Arithmetic.—

(1) 784 + 659 + 873 + 496 + 567.
(2) From 704 take 209.
(3) From 831 take 67.

(The above were read in words.)

STANDARD II.

All read—some meanings were asked, and the grammar of nouns and adjectives was taken.

Dictation.—'Horses once taken down seldom come up again; they remain to work in the mines. Here the stories told round the breakfast table ended.'

Arithmetic.—

(1) 7439 + 2586 + 9147 + 6325 + 8974 + 1588 + 4389 + 5968.
(2) From 6005 take 409.
(3) From 8040 take 617.
(4) Multiply 749,658 by 4.

(The above, with the exception of 4, were read in words.)

STANDARD III.

Arithmetic.—

A. (1) Multiply 890,765 by 890 (words).
(2) 1,098,648 ÷ 72 (factors).
(3) 39,018,675 ÷ 1497 (figures).
(4) Take £907 19s. 0¾d. from £8096 3s. 11¼d.

B. (1) 809,638 × 796 (words).
(2) 1,876,548 ÷ 1973.
(3) Add £709 0s. 8½d. + £60 9s. 3¾d. + 18s. 11¾d. + £900 9s. 9d. + £78 17s. 7¼d.
(4) Take 70,974 from 8,000,970 (words).

Dictation.—Agnes was met by a smile of kindly greeting. But, when the little weeping girl told her sad tale, the smile vanished and horror took its place upon the faces of the listeners. All leapt to their feet and thought of nothing but action—and at once.

Poetry.—'The Schooner Hesperus.' Inspector questioned children on the meaning of different parts.

Grammar.—Out of the passage.

History.—Chief events in the reign of Mary, Queen of Scots.

Geography.—General outline of Scotland.

STANDARD IV.

Arithmetic.—

A. (1) £9 19s. 10¾d. × 768.
(2) £41380 11s. ÷ 816.
(3) Reduce 1475 florins to half-crowns.
(4) Every year for 19 years, a certain field has produced an average 87 qrs. 3 bush. 3 pks. of grain. What is the total crop for the 19 years?

B. (1) £406,921 12s. 3d. ÷ 468.
(2) £64 18s. 7¼d. × 48.
(3) Reduce 618,305 ounces to cwts.
(4) To how many persons will 40,800 square poles give three acres?

History.—Charles I.—The Civil war—dealings of Parliament with Scotland very particularly.

Geography.—Chief towns in England and Ireland—Mountains in England—Rivers of Ireland.

Dictation.—'How do you think travellers cross these burning plains? Not in carriages, nor in steam boats, but on the backs of tall, long-necked, hump-backed camels. Even if you have seen camels alive, or pictures of them, you will still be glad to learn more about these very useful animals. The camel lives on grass and on the dry short herbage which is found on the edges of the desert.'

Poetry.—'Llewelyn and his dog,' well questioned—Grammar taken from the passage—many lines inverted and then analysed.

STANDARD V.

Arithmetic.—

A. (1) 716 articles at 18s. 6d. each.

(2) Bill:—

18½ lbs. of tea at 2s. 10d. per lb.
17 lbs. of sugar at 3½d. per lb.
17 hams, each 12 lbs, at 6d. per lb.

(3) A man pays 17s. 10d. as income tax. The income tax is 6d. in the pound; what is his income.

(4) Multiply $3\frac{1}{8}$ of $2\frac{1}{6}$ by $7\frac{1}{8}$ and divide the product by $3\frac{3}{5}$.

B. (1) What is the value of 6 boxes, 2 of which weigh 1½ cwts. each and 4 weigh 2 qrs. 7 lbs. each at 6½ per lb?

(2) Bill.—

14½ lbs. of Coffee at 1s. 7d. per lb.
5 boxes of fruit at 3s. 8d. each.
17 lbs. of figs at 7½d. per lb.
24 lbs. of tea at 2s. 4d. per lb.

(3) Add $\frac{23}{56} - \frac{1}{3}$ to $\frac{3}{4} - \frac{1}{12}$.

(4) 2 cwts. 3 qrs. 3½ lbs. are carried for 4s. 4d.; what weight will be carried for the same distance for £1 14s. 8d?

Composition.—(to every alternate scholar).

A WONDERFUL COLLIE.

'Some time ago a gentleman went to Florence, and took with him a noble collie, named Rover. On arriving at the city, poor Rover missed his master while being led across the station by a porter, and immediately he managed to slip his collar and went off in search. He, too, was soon missed. He was more than a favourite, he was a great friend, and his master was in despair, for placards on the high walls stated that dogs found wandering without collars would be killed. Up and down the streets Rover's master trudged, but nothing could be heard of the truant. At last, after hours of search, the gentleman went to an hotel to dine, and in the hall quietly lying down was Rover. His master then asked the landlord how the dog came and when? He was told that he came in early in the day and went straight upstairs to No. 44, where he had been till about half-an-hour before the master's arrival. It was then discovered that master and dog had stayed two years before at that very hotel, and had occupied the very room to which the dog had gone. Although their stay in Florence on the former occasion only lasted a few days, Rover remembered the place, and knew the way to his old quarters.'

Dictation.—(to the rest of the class).

'It must not be omitted to mention that this village is the paradise of cows as well as of men; indeed, one would almost suppose the cow to be an object of worship there. The same scrupulous cleanliness which pervades everything else is shown in the treatment of this useful animal. She is not permitted to roam about the place; but in winter, when she forsakes the rich pastures beyond the village, a well built house is provided for her, well painted and maintained in the most perfect order. Her stall is of ample size; the floor is scrubbed and polished, and her hide is daily curried and sponged to her heart's content.'

History.—Wars in the reign of George III. with dates—Characters of George I., II., III.

Poetry.—'Flodden.' Grammar tested from the lines.

Geography.—Different routes to Australia with distances—countries, islands, &c., passed on the way. Australia with divisions—physical features. New Zealand with towns.

STANDARD VI.

Arithmetic.—

A. (1) If 18 men dig a trench 250 yards long in 15 days, in how many days would 12 men dig a trench 400 yards long?

(2) Express 4 lbs. 6 ozs. as the decimal of a cwt.

(3) At what rate per cent. will £1,125 amount to £1,260 in 4 years, simple interest?

(4) If $\frac{1}{3}$ of a field be worth £320, what is $\frac{17}{20}$ worth, and what is the value of the whole field?

B. (1) $\dfrac{\frac{2}{11} \text{ of } 12\frac{4}{7}}{\frac{2}{5} \text{ of } \frac{5}{6\frac{2}{3}}} \div 1\frac{3}{77}$.

(2) If 16 men can reap 40 acres in 6 days of 9 hours each, how many hours must 36 men work to do 35 acres in 3 days?

(3) Find the amount of £740 for 4½ years at 4¼ per cent.

(4) Divide the sum of ·075 and ·0075 by the difference between ·75 and 7·5.

Poetry.—'Bonfire of Craiggowan' and 'Marmion and Douglas.'

Grammar from the latter piece.

Geography.—*Asia*, especially British Colonies.—*Maps*—India, Africa, and South America.

History.—Wars in and about India examined by teacher—Emancipation Acts—(*a*) Catholic, (*b*) slave, (*c*) Free trade—Education Act—Repeal of Paper Duty—Reform Acts of 1832, 1867, 1884. All these minutely gone into with dates and administrations.

Composition.—(In the form of a letter.)

THE THROW FOR LIFE OR DEATH.

When William III. of England was besieging Namur, two of his soldiers were sentenced to death for plundering contrary to orders. They were both brave men, and the General-in-Chief, who wished to

save one lessened the severity of the sentence, in so far as to allow them to throw at dice for their life. On the morning appointed for the execution the culprits were led to a drum, in order thereupon to cast the decisive throw. With a trembling hand one of the condemned took up the dice; he threw—two sixes. The next moment he saw that his fellow had also thrown—two sixes. The commanding officers and bystanders were not a little astonished at this strange occurrence; but the orders were precise, and so both the men were commanded to throw again. This was done, the dice were cast, and in the throw of both were turned up—two fives! The spectators now loudly called out that the men should be pardoned and a court martial appealed to. But the reply was that the offenders should decide their lot with new dice. Once more both of them cast and, lo—! each threw two fours. So astounded were all present, that the officers determined to refer the decision to the General-in-Chief himself, who was every moment expected. On his arrival he listened attentively to the story, and was so moved by the strangeness of the occurrence that he pardoned both.

Music.

STANDARDS I., II., AND III.

Time Test.—

| 1 :1 | 1 :— | 1 : | 1 :1 | 1 :— | — : ‖

Modulator.—Teacher pointed and gave a few easy steps. Two songs were taken.

STANDARDS IV., V., AND VI.

(*a*) d m l s d' l r' t d' d' s °d t, t, l, s, m r d t, l, s, °r m f m l t d'.

(*b*) l m l t d' l m d' t l l se l m m l l.

Ear Tests.—d d d; d m d; s l s; s f s; s f e s; d' t a l; l f r; m f l; l t d; d s m d.

Time Test.—

| 1 :1.1|1 :-.1 | 1 :—|1 : | 1.1:1.1|1.1:1 | 1 :1.1|1 :— ‖

Modulator.—Teacher pointed to modulator and gave different tests on it.

Two Songs taken, 1st notes, 2nd words.

Specific Subjects.

Mathematics, 1st Stage.—

(1) $7a\{-3a-[4a-(5a-2a)]\}$.

(2) $2x-\{3y-[4x-(5y-6x)]\}$

(3) If $a=2, b=3, x=7, y=5$, find the value of $2+2x-\{b+y-[a-x-(b-2y)]\}$.

Euclid.

Propositions VII.—XV. (inclusive)—one to each scholar.

—o—

Quarterly Arithmetical Tests.

BY JOSEPH WOLLMAN,

Head Master of the Wellgate Board School, Rotherham.

STANDARD I.—FIRST QUARTER.

1.	327	2.	987	4. There are 325 trees in one park, 560 in another, 478 in another, and 793 in another. How many trees are there in the four parks?
	4		543	
	80			
	15	3.	658	
	269		102	

SECOND QUARTER.

1.	56	2.	549	4. A baker sold 256 loaves out of 419. How many had he left?
	8		84	
	704			
	39	3.	460	
	582		432	

THIRD QUARTER.

1.	5	2.	785	4. In a village there are five hundred persons. There are 58 boys, 67 girls, and 196 women. How many men are there?
	876		276	
	43			
	927	3.	357	
	64		199	

STANDARD II.—FIRST QUARTER.

1. 27,019 + 685 + 74 + 3,507 + 49,730 + 826.

2. Multiply 58,760 by 63.

3. Take 28,607 from 30,004.

4. William had 105 marbles, and he lost 37. He afterwards bought 46, and gave 29 away. How many had he then?

SECOND QUARTER.

1. Divide thirty thousand six hundred by five. Write the answer in words.

2. What is the difference between 58,627 and 62,301?

3. 47,086 × 409.

4. How many pens are there in 57 gross boxes?

THIRD QUARTER.

1. From 17,016 subtract 47.

2. Divide 78,921 by nine.

3. Find the product of 78 and five thousand nine hundred and forty-six.

4. If it takes a train twelve hours to go 468 miles, how many miles does it travel in one hour?

STANDARD III.—FIRST QUARTER.

1, 47,730 ÷ 74.

2. What is the result if 869,372 be divided by 509?

3. The product of two numbers is 166,023 and one number is 387. What is the other number?

4. In a mixed school there are 795 scholars, and the number of boys is 27 more than the girls. Find the number of girls.

SECOND QUARTER.

1. From fifty pounds and six pence farthing take three shillings and tenpence halfpenny.

2. There are 5,280 feet in a mile; how many feet are there in 790 miles?

3. £1,050 14s. 7¼d. + £6,847 13s. 5½d. + £928 16s. 9¾d. + £506 12s. 6½d. + £39 17s. 10¾d. + £85 19s. 8d.

4. I spent two crowns, half-a-crown, two florins, and gave away 1s. 5½d. How much had I left out of a sovereign?

THIRD QUARTER.

1. What is the sum of £4,830 17s. 4½d., £26,097 18s. 11d., £8,459 6s. 8¾d., £57,920 15s. 10½d., £3,615 9s. 7¼d., and £90,274 14s. 6½d?

2. How many gross boxes of slate pencil can be made up out of 9,468 dozen?

3. How much is £19,075 6s. 9¼d. less than £28,419 2s. 8¾d?

4. I bought two houses for five hundred pounds. I sold one for £286 15s. and the other for £279 12s. 6d. How much did I gain?

STANDARD IV.—FIRST QUARTER.

1 Multiply £7,046 18s. 11¾d. by 709.

2. If 456 horses cost £9,006, what will one cost?

3. What sum is 58 times £15,603 19s. 8½d.?

4. If 6 pounds of tea at 2s. 3d. a lb. are mixed with 9 lbs. at 1s. 10d. a lb., what is the value of a pound of the mixture?

SECOND QUARTER.

1. How many eggs at 1½d. each can be bought for £7 18s. 7½d.?

2. Reduce three million fifty thousand and nineteen inches to chains, &c.

3. What is the cost of a pound of sugar if 18 cwt. 68 lbs. cost £15 3s. 11d?

4. Reduce 497,016 square inches to square yards?

THIRD QUARTER.

1. Find the value of 35 qrs. 7 bus. of flour at 1s. 8d. per peck.

2. Reduce 29 years 47 weeks 16 hours 39 sec. to seconds. (Reckon 365 days = 1 year.)

3. How many florins are worth 276 half-guineas?

4. The distance between two towns is 185 miles. If a train travel at the rate of 65,120 yards in an hour, how long will the journey take?

STANDARD V.—FIRST QUARTER.

1. What is the value of 50,078 articles at £19 9s. 9½d. each?

2. How much would be paid for 29 days 14 hours 45 min. at £1 18s. per day of 24 hours?

3. Find the value of a million and a half eggs at ¾d. each.

4. What would be the cost for 5 tons 17 cwt. 50 lbs. 12 oz. at £11 13s. 4d. per cwt?

SECOND QUARTER.

1. If 17 dozen articles cost £18 14s., what is the value of 29 score?

2. What is the cost of 35 yards 34 in. of silk at 5s. 3d. per yard?

3. Find the value of 7 cwt. 2 qrs. 19 lbs. of tea, if £124 18s. 10d. be paid for 9 cwt. 26 lbs.

4. Make a bill for the following:—

3 stone of sugar at 2 lbs. for 3½d.;
4½ stone of sugar at 2½ per lb.;
7 lbs. 6oz. of tea at 3s. 4d. per lb.;
9¼ lbs. of coffee at 1s. 9d. per lb.;
15½ lbs. of cheese at 10½d. per lb.

THIRD QUARTER.

1. Simplify:—

$$(\tfrac{4}{9} - \tfrac{1}{6} + \tfrac{5}{8}) - (\tfrac{9}{10} + \tfrac{2}{3} - \tfrac{3}{4}).$$

2. What fraction must be added to the sum of $\frac{1}{6}$, $\frac{1}{8}$, and $\frac{1}{10}$, to make the result a whole number?

3. A bankrupt owes altogether £1,250. If I receive £270 5s. for a debt of £460, what is the value of his assets?

4. My income is 250 guineas. I spend $\frac{5}{7}$ of it, and save the remainder. How much do I save in 2 years 9 months?

STANDARD VI.—FIRST QUARTER.

1. By what fraction must $7\frac{3}{4}$ be multiplied to give a product of $\frac{7}{8} + \frac{5}{6} + \frac{4}{3}$?

2. By how much is ·7596 nearer to ·75957 than ·7595?

3. Simplify:—

$$\frac{\frac{5}{8} - \frac{3}{5}}{\frac{7}{9} + \frac{1}{6}} \times \frac{4}{7\frac{1}{3}}.$$

4. Divide the product of ·549 and ·0735 by ·63.

SECOND QUARTER.

1. What is the value in lbs. of ·765 of $\frac{3}{7}$ of 5 tons 16 cwt?

2. After spending $\frac{5}{11}$ of my money I found I had left a sovereign, half-a-sovereign, a crown, three half-crowns, two florins, seven shillings, and nine sixpences. How much had I at first?

3. What decimal of £7 15s. is $\frac{9}{7}$ of $\frac{5}{8}$ of 18s. 1d. ?

4. A dealer sold 8 cwt. 97 lbs. of coffee for £70 7s. 3d. What was that per quarter ?

THIRD QUARTER.

1. One pipe can fill a cistern in 8 minutes, and it can be emptied by another pipe in 6 minutes. If the cistern is $\frac{2}{3}$ full, and both pipes are opened together, in what time will it be empty ?

2. What is the amount of £675 for 219 days at $3\frac{1}{4}$ per cent ?

3. When the income tax was $7\frac{1}{2}$d. in the £ I paid £9 10s. $7\frac{1}{2}$d. more than when it was 5d. in the £. What is my income ?

4. By investing £760 I obtain an income of £34 4s. per annum. What is the rate per cent. ?

STANDARD VII.—FIRST QUARTER.

1. If 2,500 men have $3\frac{1}{2}$ lbs. of food each per day for 18 weeks, how much ought they to have daily, so that the same provisions will last 500 more men 21 weeks ?

2. If £560 was placed in a bank and allowed to remain until it amounted to £736 8s. at $3\frac{1}{2}$ per cent. simple interest, how long was it in ?

3. If 39 men build a wall 65 yards long, 2 yards high, and $1\frac{1}{2}$ feet thick in 21 days, in what time will 28 men build a wall 63 yards long, 8 feet high, and 20 inches thick ?

4. A bankrupt was able to pay $\frac{5}{8}$ of $\frac{4}{9}$ of his debts. What was the debt due to a creditor who received £19 15s. ?

SECOND QUARTER.

1. Find the average of £5·85, £9$\frac{3}{8}$, £4·1$\dot{6}$, £7·625, and £·1875.

2. At what rate per cent. will £790 amount to £804 9s. 8d. in 4 months ?

3. Seven men and five boys weighed altogether 115 stone 6 lbs. The average weight of the boys was 7 stone 11 lbs. What was the average weight of the men ?

4. What is the commission on £2,978 15s. at £$\frac{3}{4}$ per cent ?

THIRD QUARTER.

1. If coals are bought at £6 5s. for $11\frac{1}{2}$ tons, at what price per cwt. must they be sold to gain 15 per cent. ?

2. From a certain kind of iron ore 27 per cent. of iron can be extracted. How much can be obtained from 3,945 tons of ore ?

3. Tea at 2s. 8d. per lb. is mixed with tea at 3s. 8d. per lb. What should be the proportion of the mixture to sell at 3s. 4d. per lb. ?

4. The population of a town increased 12 per cent. between 1871 and 1881. The population in 1881 was 42,336. What was the population in 1871 ?

ANSWERS.

STANDARD I.

	FIRST.	SECOND.	THIRD.
1.	695.	1,389.	1,915.
2.	444.	465.	509.
3.	556.	28.	158.
4.	2,156 trees.	163 loaves.	179 men.

STANDARD II.

	FIRST.	SECOND.	THIRD.
1.	81,841.	6,120.	16,969.
2.	3,701,880.	3,674.	8,769.
3.	1,397.	19,258,174.	463,788.
4.	85 marbles.	8,208 pens.	39 miles.

STANDARD III.

	FIRST.	SECOND.	THIRD.
1.	645.	£49 16s. $7\frac{1}{2}$d.	£191,199 3s. $0\frac{1}{2}$d.
2.	1,708.	4,171,200 feet.	789 boxes.
3.	429.	£9,459 14s. $11\frac{3}{4}$d.	£9,343 15s. $11\frac{1}{2}$d.
4.	384 girls.	2s. $0\frac{1}{2}$d.	£66 7s. 6d.

STANDARD IV.

	FIRST.	SECOND.
1.	£4,996,286 16s. $2\frac{3}{4}$d.	1,269 eggs.
2.	£19 15s.	4,002 chains 12 yds. 3 in.
3.	£905,031 3s. 1d.	$1\frac{3}{4}$d.
4.	2s.	383 sq. yds. 4 ft. 72 in.

THIRD.

1. £95 13s. 4d.
2. 943,027,239 seconds.
3. 1,449 florins.
4. 5 hours.

STANDARD V.—FIRST.

1. £975,999 7s. 1d.
2. £56 5s. $4\frac{1}{4}$d.
3. £4,687 10s.
4. £1,370 5s. $8\frac{3}{4}$d.

SECOND.

1. £53 3s. 4d.
2. £9 8s. $8\frac{1}{2}$d.
3. £103 15s. 11d.
4. 6s. $1\frac{1}{2}$d. + 13s. $1\frac{1}{2}$d. + £1 4s. 7d. + 16s. $2\frac{1}{4}$d. + 13s. $6\frac{3}{4}$d. = £3 13s. 7d.

THIRD.

1. $\frac{33}{385}$.
2. $\frac{3}{110}$.
3. £734 7s. 6d.
4. £206 5s.

STANDARD VI.

	FIRST.	SECOND.	THIRD.
1.	$\frac{8}{15}$.	4,259$\frac{1}{4}$ lbs.	16 minutes.
2.	·00004.	£3 19s. 9d.	£688 3s. 3d.
3.	$1\frac{11}{15}$.	·0416.	£915.
4.	·0634095.	£2 4s. 4d.	$4\frac{1}{2}$ per cent.

STANDARD VII.

	FIRST.	SECOND.	THIRD.
1.	$2\frac{1}{2}$ lbs.	£5 9s. $11\frac{1}{4}$d.	$7\frac{1}{2}$d.
2.	9 years.	$5\frac{1}{2}$ per cent.	1,065 tons 3 cwt.
3.	42 days.	10 stone 13 lbs.	1 lb. at 2s. 8d. to 2 lbs. at 3s. 8d.
4.	£36 17s. 4d.	£22 6s. $9\frac{3}{4}$d.	37,800.

Practical Kindergarten Lessons for English Elementary Schools.

BY MRS. MORTIMER.

Lecturer at the Home and Colonial Training College.

XIV.

GIFT X.

EXAMPLES OF LESSONS.—DRAWING.

The material of this occupation consists of chequered slates and afterwards of chequered paper for drawing on. This plan of teaching drawing is one of Fröbel's own invention, and adapted by him to suit the age and capacity of the child. He gives the youngest children (3 and 4 years) the chequered slate, the lines of which help them in drawing straight lines.

1. They are first taught to draw perpendicular lines one square long—these are examined and compared with anything they may remember as being in a similar position; thus, during the lesson, the children may draw 6 posts, 6 trees, 6 little boys, 6 little girls, 6 soldiers, &c., &c. All these different upright things being represented by perpendicular lines. Proceeding in this way, it will be found that the drawing lesson is a source of great pleasure to the children, they try to make all their lines as straight as possible, so as to better represent the objects.

When the children are able to draw on one square very fairly, they may proceed to lines of two squares, the same kind of conversation being maintained. The children then proceed to lines of three, four, and five squares. The youngest children will probably not be able to draw lines of more than two or three squares, but these can be varied by changing their position on the squares. Sets of lines of different lengths may then be combined in various forms (Plate XXXIII.).

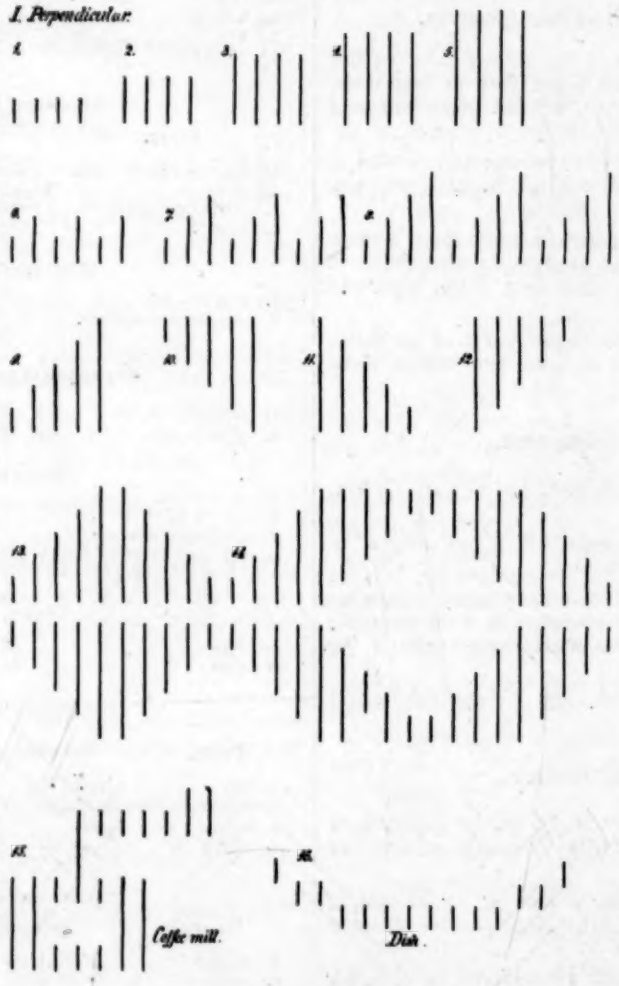


Plate XXXIII.

2. The horizontal line (Plate XXXIV.) follows, and in the same order; first the different lengths being drawn, and afterwards the lengths combined.

3. The next step (Plate XXXIV.) is the combination of perpendicular and horizontal lines forming right angles at the point of contact. First, lines of equal and then of unequal lengths are drawn, *e.g.*, perpendicular line one square, horizontal line two squares, &c. These combinations will lead to the drawing of squares, ladders, steps, zigzags, crosses, &c.

4. Plate XXXV. When the children have had sufficient practice with the perpendicular and horizontal lines they may proceed to the oblique line, beginning with the diagonal of one square, and then of two squares, &c., and drawing the lines first inclining to the right and then to the left. In a similar way the diagonal of oblongs should be taught. These in combination will form trellisses, and interlacing patterns.

The three kinds of straight lines may then be used in a variety of simple, ornamental designs.

The geometrical forms and the outlines of many common objects will suggest a pleasing variety of exercises for the children.

Lastly the curved line is introduced, the semicircle and circle affording sufficient practice, and enabling many other forms to be made. This, however, is generally too difficult for the children of the Infants' School.

II. Horizontal.

III. Combination of Perpendicular and Horizontal.

Plate XXXIV.

IV. Oblique.

V. Combination of Perpendicular, Horizontal, and Oblique.

Plate XXXV.

GIFT XI.

PERFORATING.

This Gift is placed in the fourth group of Gifts, viz., Points. It represents the smallest part of the solid—the corner. The materials for this occupation consist of chequered paper, a perforating needle, and a soft pad of felt which is placed under the paper to be perforated; subsequently plain paper and simple drawing copies are used for perforating.

In the first lesson the Teacher should, as with the previous Gifts, interest the children in the materials before them. She should be provided with a chequered board which she should use to show the children where to begin their work and how to proceed. Great care must be taken to show the children how to hold their prickers, if they are not held perpendicularly the holes will not be good. It is necessary also to be careful about the size of the holes, which should be neither too large nor too small. The same course of instruction is followed as in drawing, the children first dealing with perpendicular lines, then with horizontal, and finally with oblique ones.

For the first exercise the children should prick in the corners of the squares, the top and bottom of the perpendiculars. Next they should prick the top, bottom, and middle of the perpendiculars, thus making three pricks for each perpendicular of one square. After this exercise they can make two pricks between the first two, and even three. The increase in the number of pricks increases the difficulty as the children must make them all on the perpendicular line, and all at equal distances apart. When the children have done a sufficient number of copies of perpendicular lines one square long, they may proceed to lines of two, three, four, and five squares. In every case there must be at least three pricks on each perpendicular of one square, one in each corner and one in the middle. As in drawing, these lines of different lengths may then be combined to make various forms. The horizontal line is next pricked, and in the same order. Then follows the oblique line and finally the three lines are combined in various ways.

When the children can prick patterns nicely on the chequered paper simple drawing copies are given them; these are placed over plain paper. The children then prick the outlines of the drawings, and when the copy is removed they see that they have the same traced on the plain paper underneath. This work may be nicely finished by *shading*, this is done by turning the paper over and making very many tiny perforations very close together in certain parts. When the paper is turned on the right side again these parts will be raised, and make the pattern look very pretty. The pad used for shading should consist of several sheets of blotting paper, as a harder pad than the felt one is required for this part of the work. The finer the perforating needle the better the shading looks. As a great deal depends upon the effect these exercises have on the mental development of the child, the teacher must be very careful to select suitable copies. The designs should be taken principally from the animal and vegetable kingdoms. While the copies are being perforated, the children, under the careful supervision, and aided by the appropriate conversation of the Teacher, will learn much more about the subject represented by the pattern, than if they were merely receiving a lesson with a picture in front of them.

By this occupation children acquire steadiness of eye and hand, accuracy and correct measurement, their inventive powers are called into play, and a refined taste is cultivated.

The patterns given for Drawing may be used as patterns for Perforating. Simple Drawing Books and Cards, such as those published by Nelson and others, are well adapted for perforating and shading.

GIFT XII.

MATERIAL FOR EMBROIDERING.

The material for this occupation is chequered paper (indeed the paper that has already been used for Perforating may now be used for Embroidering), needles, and coloured silk, cotton, or wool. The course of instruction is the same as for Perforating. This occupation should not be introduced simultaneously with Perforating, but should follow when the children can perforate fairly well. After the exercises on chequered paper the children are allowed to embroider the flowers, fruits, animals, &c., previously perforated. The element of *colour* is here introduced. The children should first work only with silk, wool, or cotton, of one colour, then two, and finally they should combine many colours. Great care should be taken in the choice and arrangement of these. Where natural objects are embroidered they should be worked in colours as true to nature as possible.

In this as well as in perforating much useful information can be imparted by simple conversations between Teacher and children, while they are at work, *e.g.*, they should first talk about the materials with which they work, and then the pattern which is being embroidered would form the subject for useful lessons. The very fact of the child making a copy of the object referred to in the lesson awakens his interest and gives him greater pleasure not only in what he is doing but in listening to his teacher. Whenever the child sees his work it will remind him of the interesting facts he learnt while executing it.

(To be continued.)

—o—

Tests in Mental Arithmetic.

STANDARD I.

1, How many are 4 times 8 and 5 more? 37.
2. How many more are wanted to make two score? 3.
3. How many are 2 + 3 + 4 three times? 27.
4. How many pennies could I get for 36 farthings? 9.

5. How many more farthings are wanted to make a shilling? 12.

6. If a boy saves 3d. a week, how much will he save in 6 weeks? 1s. 6d.

7. If he spends a halfpenny weekly out of it, how much would he have? 1s. 3d.

8. How many halfpennies could he get for that sum? 30.

9. If a boy has 2d. and his sister has twice as much, how much have they together? 6d.

10. How many marbles at 5 for a halfpenny could they buy with that sum? 60.

11. If these marbles are divided among 3 boys, how many would each get? 20.

12. How many twenties are there in a hundred? 5.

Standard II.

1. How many are half a gross? 72.

2. What would 72 oranges cost at ½d. each? 3s.

3. If they are sold at ¾d. each, how much would be gained? 1s. 6d.

4. How many twopenny slates could be bought for 1s. 6d.? 9.

5. How many threepenny ones could you get? 6.

6. Take three times fivepence from a florin. 9d.

7. Add together 11, 13, 15, and 17. 56.

8. How many more are wanted to make 5 dozen? 4.

9. How much are 56 sixpences? £1 8s.

10. How many more shillings are wanted to make two pounds? 12.

11. How many threepences could you get for 12s.? 48.

12. If you bought two yards of cloth at 4s. 6d. a yard, what change would you get out of half-a sovereign? 1s.

Standard III.

1. A boy gets 5s. a week. How long will it take him to earn £2? 8 weeks.

2. How much will he earn in 13 weeks? £3 5s.

3. If slate pencils are 20 a penny, how much would a thousand cost? 4s. 2d.

4. How many could you get for 7½d.? 150.

5. If 9 lbs. of beef cost 6s. 9d., what is that per lb.? 9d.

6. A man works 10 hours a day and half the time on Saturday. How many hours does he work weekly? 55.

7. What are his weekly wages at 6d. an hour? £1 7s. 6d.

8. What would half-a-pound of tea cost at 2½d. an ounce? 1s. 8d.

9. What would it cost at 4½d. for two ounces? 1s. 6d.

10. How many hours are there in 1,500 minutes? 25.

11. How many pints are there in 25 gallons? 200.

12. What would 25 gallons of milk cost at a penny a pint? 16s. 8d.

Standard IV.

1. How many half-crown books can be bought for £4 15s.? 38.

2. How many sixpenny ones could be bought for the same sum? 190.

3. How much is gained on 200 eggs bought at ½d. each, and sold at 8 for 6d.? 4s. 2d.

4. How many must be sold to gain half-a-sovereign? 480.

5. How many lbs. are there in 3½ cwt.? 392.

6. What would 3½ cwt, of cheese cost at a shilling a lb.? £19 12s.

7. If a stone of soap cost 3s., what will be the cost of 4½ cwt.? £5 8s.

8. What will 2½ gallons of milk cost at 1½d. a pint? 2s. 1d.

9. I had a sovereign and spent 12s.; what part of a sovereign had I left? ⅗.

10. What part had I spent? ⅖.

11. After losing three-quarters of his marbles a boy had 15 left. How many had he at first? 60.

12. If he had lost $\frac{7}{10}$ of them, how many would he have had left? 18.

Standard V.

1. If £20 gain £1 6s., what would £100 gain in the same time? £6 10s.

2. A bankrupt's debts amount to £720, but he can only pay 13s. 4d. in the £. What is the value of his property? £480.

3. How much will it cost to paint a wall 20 feet long and 15 feet high at 2d. a square foot? £2 10s.

4. If a boy walk 3½ miles an hour, how long will it take him to walk 28 miles? 8 hours.

5. If seven-eighths of an estate is worth £35,000, what is the value of a quarter of the estate? £10,000.

6. Reduce $\frac{9}{12}$ to its lowest terms. $\frac{3}{4}$.

7. Add together $\frac{4}{10}$ and $\frac{3}{15}$. $\frac{3}{5}$.

8. What is the sum of $\frac{1}{3}$ and half of $\frac{1}{3}$? $\frac{1}{2}$.

9. Express $\frac{1}{2}$ as a decimal. ·5.

10. What is the tenth part of this expressed decimally? ·05.

11. After spending $\frac{5}{8}$ of my money I had half-a-crown left. How much had I at first? 6s. 8d.

12. What is the interest on £675 for a year at 3 per cent.? £20 5s.

STANDARDS VI. AND VII.

1. Multiply $2\frac{5}{8}$ by $2\frac{2}{7}$. 6.

2. Divide $3\frac{5}{9}$ by $2\frac{2}{3}$. $1\frac{1}{3}$.

3. Reduce $\frac{1}{8}$ of a crown to the decimal of a shilling. ·625.

4. Express $\frac{1}{3}$ of $1\frac{3}{4}$ as a decimal. ·583.

5. What decimal is left if this decimal is subtracted from unity? ·416.

6. In what time will £300 amount to £390 at 6 per cent.? 5 years.

7. If the rate per cent. was 4, how long would it take? $22\frac{1}{2}$ years.

8. What percentage of a lb. avoirdupois is an ounce? $6\frac{1}{4}$ per cent.

9. What is $6\frac{1}{4}$ per cent. of 2 lbs. troy? $1\frac{1}{2}$ ounces.

10. If an article costing 4s. 6d. was sold for 4s., what was the loss per cent.? $11\frac{1}{9}$ per cent.

11. If it had cost 4s., and had been sold for 4s. 6d., what would have been the gain per cent.? $12\frac{1}{2}$ per cent.

12. If an article was sold for 4s. 6d. at a loss of 10 per cent., what was the cost price? 5s.

Practical Perspective for Pupil Teachers.

BY

E. G. BAKER, B.SC., B.A.,

Vice-Principal of the Training College, Carmarthen.

PROJECTION.

Plans.—Suppose we measure the lengths of the walls of our room along the level of the floor, and also the angles at the corners of the room, and then draw on a piece of paper lines to represent the edges of the floor, using $\frac{1}{8}$th of an inch to represent a foot, and drawing the lines so that they make the proper angles at their points of meeting; we shall have on our paper what is called a plan of the floor on a scale of $\frac{1}{8}$ in. to the foot. The scale chosen will of course be a convenient one, depending on the magnitude of the object of which the plan is required, &c. Similarly we might draw a plan of the ground on which a house stands; and a map of a town is nothing but a plan showing, on a convenient scale, the amount of ground occupied by streets, houses, &c., and the directions of the streets. In a word, a plan shows lengths, breadths, and positions.

Instead of drawing the plan of the ground on which a house stands we might draw the *ground plan, i.e.*, the plan on the level of the ground, of the house itself, and in it would be shown walls (their lengths, breadths, and positions), openings for doors, and all things on a level with the ground.

But if the house had two or more stories, the plan for these would differ from that for the ground floor, and so we see that a house may have different plans for different levels.

Plans by Projection.—Now the builder, for convenience, keeps such plans separate, but in the case of the solids and other objects with which we shall have to deal in what follows, one drawing, called the plan, will include the plans at all levels. This drawing is supposed to be obtained as follows:—

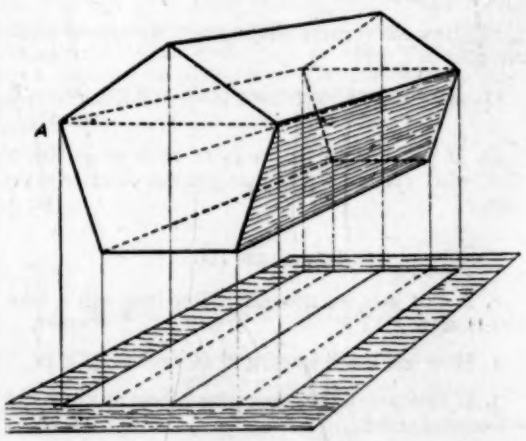


Fig. 5.

The figure represents a right pentagonal prism, and for convenience all its edges are shown.

We will explain by means of this solid some terms which will frequently recur.

The name *pentagonal* is given on account of the two pentagonal faces which are called the *ends* of the solid. Thus we may have *triangular*, *square*, *hexagonal*, &c., prisms, according to the shape of the two ends.

The line joining the centres of the two ends (dotted in the figure) is called the *axis* of the prism.

The other faces of the solid are called *sides*. When the sides are rectangles the prism is said to be a *right* prism (cf. right angle), and in this case the axis is perpendicular to each end, and the ends are equal and parallel.

If we suppose the solid to stand on one of its rectangular faces, on a horizontal plane, its ground plan will be that face drawn to a convenient scale. The plan at the level of the point A will be a different figure. Now to enable us to represent both these on one plan we suppose the solid suspended, so that the face previously on the horizontal plane remains horizontal, and then imagine perpendiculars drawn from every corner of the solid to the plane (fig. 5). Joining the points where these perpendiculars meet the plane, we get such a figure as is shown in fig. 6. It will be seen that EFGH is the plan of the lowest face, and ABCD the plan of the solid on the level of A in fig. 5, while KL is the plan of the ridge and the axis.

Fig. 6.

The plan EFGH is dotted to show that it represents a face lying below the level of ABCD.

This is the method known as Orthogonal Projection. The perpendiculars are called projectors, and the term orthogonal (= right-angled) is used to describe the method, because the projectors are drawn perpendicular (*i.e.*, at right angles) to the plane to which the plans are supposed to be transferred.

Elevations.—All that was said above, in the paragraph on plans, about drawing the plan of the floor of our room, will apply also to drawing what is called the elevation of any one of its walls, except that we now measure length and height.

An elevation in fact is a plan of an object showing *length* and *height* instead of *length* and *breadth*.

Elevations by Orthogonal Projection.—Similarly, the remarks on projection for plans apply to projection for elevations, except that, in this case, the plane on which the perpendiculars are imagined to be drawn is a vertical one.

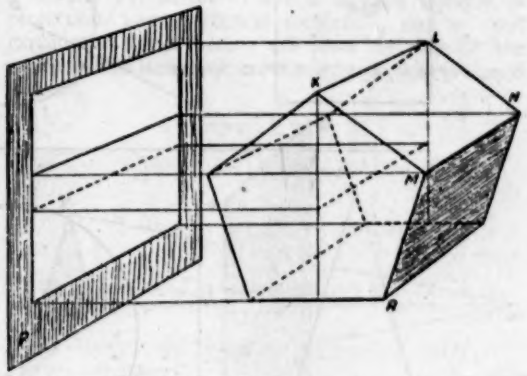


Fig. 7.

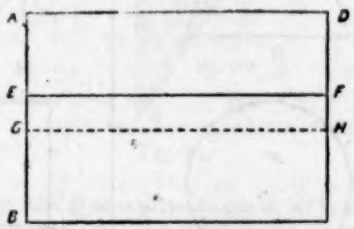
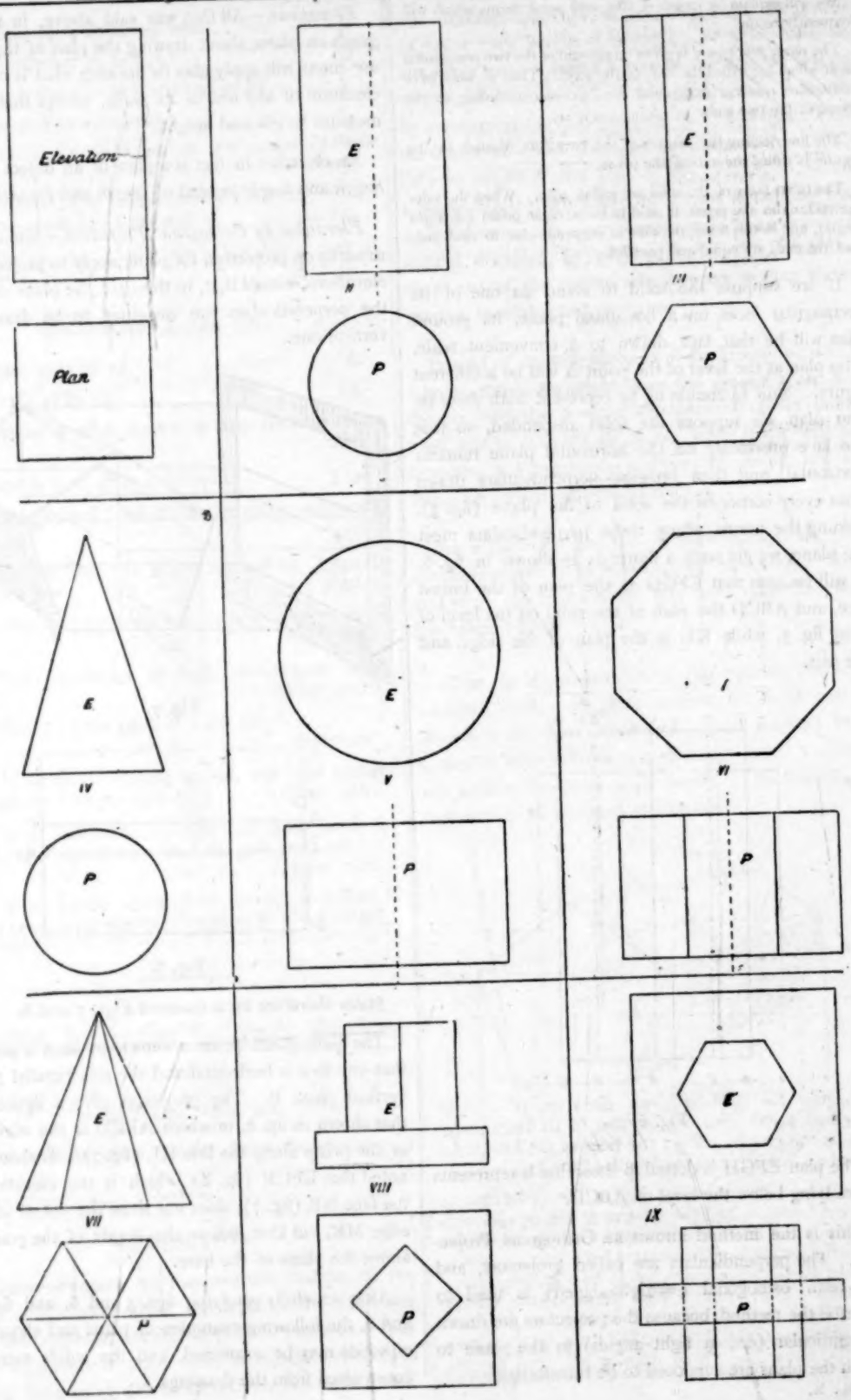


Fig. 8.

Study therefore for a moment Figs. 7 and 8.

The pentagonal prism is shown in such a position that one face is horizontal and the axis parallel to the vertical plane P. The projectors give a figure like that shown in fig. 8, in which ABCD is the elevation of the prism along the line KL (fig. 7). It should be noted that EFCB (fig. 8), which is the elevation of the face NR (fig. 7), does not show the *length* of the edge MR, but that BE is the *height* of the point M above the plane of the base.

After carefully studying figs. 5 and 6, and figs. 7 and 8, the following examples of plans and elevations of solids may be examined, and the solids mentally constructed from the drawings.


Elevation
Plan
E
P
II
III
IV
V
VI
VII
VIII
IX

I. The plan and elevation of a right square prism.
II. The plan and elevation of a right cylinder with its axis vertical. The dotted line shows the axis.
III. The plan and elevation of a hexagonal prism with axis vertical and two rectangular faces parallel to the vertical plane.
IV. The plan and elevation of a cone.
V. The plan and end elevation of a cylinder with its axis horizontal.
VI. The plan and end elevation of an octagonal prism with its axis horizontal.
VII. The plan and elevation of a hexagonal pyramid.
VIII. The plan and one elevation of a square slab on which stands a square prism.
IX. The plan and front elevation of a rectangular slab through the centre of which passes a hexagonal prism with its axis horizontal.

EXERCISES.

Scale $\frac{1}{2}$ in. to the foot.

In the following exercises the difficulty will be found to be, chiefly, to decide what is to be drawn first.

The pupil is advised to place the solids in front of him if possible.

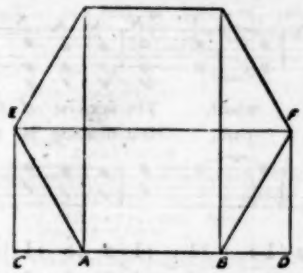


Fig. 9.

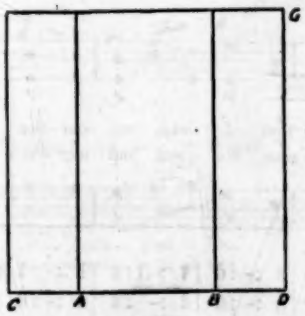


Fig. 10.

1. Draw the plan and end elevation of a right hexagonal prism standing on one of its rectangular faces on the ground plane; the sides of the hexagonal ends are 2 ft. long, and the length of the axis is 4 ft.

Method.—Draw the elevation of the end first. It will be a hexagon, and the sides of it will be one inch long, since half an inch represents a foot (fig. 9). From the end elevation may be obtained the various widths required for the plan, which has to be 2 in. long, since the axis is 4 ft. in length. First draw GD two inches long. Then from D draw DC at right angles, and mark off along it DB, DA, and DC from fig. 9. Complete the rectangles. The drawing will then be the plan of the solid.

2. Draw, with same dimensions as above, the plan and end elevation of a right pentagonal prism standing on one of its rectangular sides as base. (Commence with the end elevation.)

3. Draw the plan and side elevation of the hexagonal prism in 1.

(Make use of the end elevation for both plan and side elevation.)

4. Draw the plan and side elevation of a right octagonal prism standing on one of its rectangular faces as base. Sides of octagonal ends 2 ft. long, length of axis 5 ft.

(Here the end elevation must first be drawn, and from it must be obtained both plan and side elevation.)

Conical Projection.—There is another method of projection, named conical projection, and a short explanation of its nature will pave the way for the subject which these articles are more especially designed to teach.

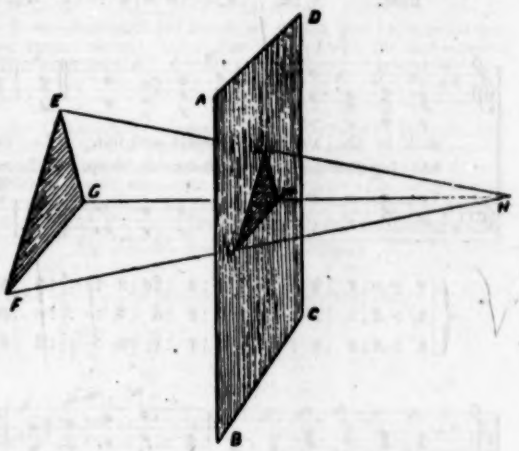


Fig. 11.

Suppose ABCD to represent a plane, EFG a triangle on one side of it, and H a point on the opposite side.

Now imagine straight lines drawn from the angles of the triangle to the point H. As we have before seen, these lines cut the plane in points, one for each. Let these points be K, L, and M. Join KL, LM, and MK. Each of these lines is on the plane, and thus we have on the plane a triangle. This triangle KLM is said to be the *conical projection* of the triangle EFG on the plane ABCD for the *vertex* or *pole* H. Now it will be readily seen that both the size and shape of the projection depend on the relative positions of the object, the plane, and the pole.

Thus if the plane be moved nearer the triangle EFG, the projection KLM will be larger, and *vice versâ*. Also if H be moved nearer the plane the projection will be smaller, and *vice versâ*.

The reason for the term conical may be gathered from considering that a cone tapers to a vertex.

The connection of this with Perspective Drawing we now proceed to consider.

(To be continued.)

THE USEFUL PLOW.

(OLD BALLAD.)

Siciliano. *Music by* T. CRAMPTON.

1st TREBLE.
2nd TREBLE.
BASS.

1. A coun - try life is sweet, In mod - er - ate cold and heat; To
2. They rise with the morn-ing lark, And la - bour till al - most dark; Then

KEY E♭. *Siciliano.*

walk in the air, how pleasant and fair. In eve - ry field of wheat, The fair - est of flow-ers a -
fold - ing their sheep, they has-ten to sleep. While eve - ry pleasant park, Next morning is ringing with

- dorn-ing the bow - ers And eve - ry mea - dow's brow; To that I say, no cour - tier may Com -
birds that are sing - ing On each green, ten - der bough; With what con - tent and mer - ri - ment Their

- pare with they who clothe in grey, And follow the use - ful plow, And follow the use - ful plow.
days are spent whose minds are bent, To follow the use - ful plow, To follow the use - ful plow.

Query Column.

RULES.

1. **Each correspondent is restricted to *one question*.** We should be much obliged if correspondents, who send questions for solution, would give (if possible) the required answer, and the source from which the question is obtained.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. ☞ **When a pseudonym is adopted it should be written at the end of the query, and the real name and address on a separate piece of paper.**

4. Correspondents are requested to write their queries *legibly*, and on one side of the paper only.

5. Replies will not be sent through the post.

6. Queries must reach the office *not later than the 12th of the month*, or they cannot be attended to in the following issue.

*** All communications for this column should be addressed—'*The Query Editor*,' *The Practical Teacher, Pilgrim Street, Ludgate Hill, London, E.C.*

Arithmetic.

1. CONSTANT.—At what rate per cent. will £5,000 amount to £5,788 2s. 6d. in three years, compound interest?

Amount of £5,000 in 3 years = £5,788·125,
" £1 " = £5,788·125 ÷ 5,000
= £1·157625,
" £1 in 1 year = (3rd or cube root of 1·157625) £,

1·157625(1·05
1
$10^2 \times 300 = 30000$ | 157625
$10 \times 5 \times 30 = 1500$
$5^2 = 25$
31525 | 157625

Amount of £1 in a year = £1·05,
" £100 " = £105,
∴ Rate = 5 per cent. Ans.

2. M. H.—A man having bought a lot of goods for £150 sells ⅓ at a loss of 4 per cent.; by what increase per cent. must he raise that selling price in order that by selling the rest at the increased rate he may gain 4 per cent. on the whole transaction?
(*Hamblin Smith.*)

Selling price of ⅓ of goods = £50 − 4 per cent. of £50
= £50 − £2
= £48;
" all = £150 + 4 per cent. of £150
= £150 + £6
= £156;
∴ " remainder = £156 − £48
= £108.

Goods costing £50 were sold for £48,
" £100 would be sold for £96,
But, goods costing £100 have to be sold for £108;
Increase on £96 = £108 − £96 = £12,
∴ Increased rate per cent. = $\frac{12}{96}$ of 100
= ⅛ of 100
= 12½. Ans.

3. CLAUDE.—Supposing two bicyclists, A and B, to traverse in *opposite* directions the rim of a circle, the circumference of which measures 15 miles, A at the rate of 11, B at the rate of 13 miles an hour, at what distances from their common starting-point will they first meet?

If they continue, where and when will they *next* meet? When will they *together* reach their original starting-point, and what distance will each *then* have altogether travelled?
(*College of Preceptors' Exam. 1888.*)

(1) Time when they first meet = $\frac{15}{11 + 13}$ of an hour
= 1½ hr.
= ⅝ hr.
∴ A travels (11 × ⅝) miles = 6¾ miles,
B " (13 × ⅝) miles = 8⅛ miles.
(2) They next meet in ⅝ hr. × 2 = 1¼ hrs.
A travels (11 × 1¼) miles = 13¾ miles.
∴ They meet (15 − 13¾) miles or 1¼ miles from starting-point.

(3) A completes a round in 1⅞ hrs.,
B " " 1⅛ hrs.;
G.C.M. of 11 and 13 = 1,
∴ They will meet at starting-point in 15 hours.
A will have travelled (11 × 15) miles = 165 miles
B " " (13 × 15) miles = 195 miles.

Note.—Post-card was forwarded stating that 17½ seconds was the correct answer, but it was returned with the endorsement 'Not to be found.'

Algebra.

1. CELTIC.—From two places at a distance of 320 miles two persons A and B set out in order to meet each other. A travelled 8 miles a day more than B, and the number of days in which they met was equal to half the number of miles B went in a day. Find how far each travelled before they met.
(*Todhunter's* 'Algebra for Beginners.')

Let x = B's rate per day in miles,
Then $x + 8$ = A's " " ;
And $\frac{320}{x + x + 8}$ = number of days when they met.

$$\therefore \frac{320}{2x + 8} = \frac{x}{2}$$
$$\frac{160}{x + 4} = \frac{x}{2}$$
$$320 = x^2 + 4x$$
$$x^2 + 4x + 4 = 324$$
$$x + 2 = \pm 18$$
$$x = \pm 18 - 2$$
$$\therefore x = 16 \text{ or } -20.$$

B's rate per day = 16 miles,
A's " = 24 miles;
Number of days when they met = $\frac{320}{16 + 24}$,
= 8.
∴ A travelled (24 × 8) miles = 192 miles,
B " (16 × 8) miles = 128 miles.

Mensuration.

1. S. W.—The surface of a pond is the shape of half a circle, having radius of 27 feet. Its depth at centre of base is 6 feet. Find its cubical content.

Diameter of sphere of which the pond might be considered half a segment = $\{(27^2 \div 6) + 6\}$ ft.
= 127½ ft.

Volume of segment of sphere whose radius is r and height of segment is h

$$= \frac{\pi h^2}{6}(6r - 2h),$$

π being 3·1416.

∴ Volume of pond = $[\frac{1}{2} \times \frac{3{\cdot}1416 \times 6^3}{6} \times$
$(6 \times 2\frac{1}{2}^2 - 2 \times 6)]$ cub. ft.
= $[9{\cdot}4248 \times (2\frac{1}{2}^2 - 12)]$ cub. ft.
= $(9{\cdot}4248 \times 370{\cdot}5)$ cub. ft.
= 3,491·8884 cub. ft.
Reckoning 1 cub. ft. to contain 6¼ gals.,
Pond contains (3,491·8884 × 6¼) gals. = 21,824·3025 gals. Ans.

General.

1. SCIENCE.—Find the relation between the power and the weight in the case of a rough inclined plane, when motion up the plane is about to ensue.

On a given rough inclined plane, when the power acts along the plane, let P_1 be the power which will just pull the body up the plane, and P_2 that which will just not let it slide down; show that a power equal to $\frac{1}{2}(P_1 + P_2)$ would just support the body, if the plane were smooth. (*Science Exam. 1884.*)

The first part is book work.

If α = inclination of plane, and μ = co-efficient of friction,

$P_1 = W(\sin\alpha - \mu\cos\alpha)$,

$P_2 = W(\sin\alpha + \mu\cos\alpha)$,

Adding] $P_1 + P_2 = 2W\sin\alpha$

$\therefore \frac{1}{2}(P_1 + P_2) = W\sin\alpha$.

On a smooth inclined plane when there is equilibrium

$P = W\sin\alpha$,

$\therefore \underline{P = \frac{1}{2}(P_1 + P_2)}$.

2. DOUTEUX.—Consult a book on wave motion. Any book on the advanced course of light (South Kensington Syllabus), will furnish all you want. Make a simple pendulum; let it swing backwards and forwards; the extent of the swing to the right, say, is the amplitude, the *distance of the pendulum at any instant from its position of rest* is the phase, the interval of time from passing a given point to passing it again in the same direction is called the *periodic time*.

3. W.G.—A solution to your query will appear in our next issue.

4. PUZZLED.—The meaning is: Tell me if you have discovered whether he accuses the duke on account of an old grievance, or from honourable motives because he has found him to be guilty of treachery. The answer to this question is thus given: So far as I could learn he appeals against the duke because he believes him to be plotting mischief against your highness, not on account of any grudge he bears him. This being the meaning the analysis is plain.

5. NEANDER.—The volume of a cylinder or prism is A^2h, where A^2 is the area of the base and h is the perpendicular height.

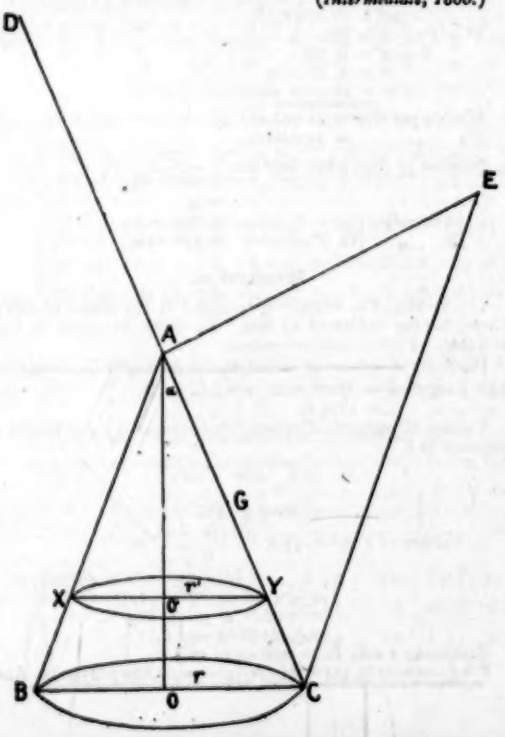
The volume of a cone or a pyramid is $\frac{1}{3}A^2h$, where A^2 is the area of the base, and h is the perpendicular height.

$\therefore$ if the base and altitude be the same

Volume of prism : volume of pyramid :: 1 : $\frac{1}{3}$.

6. RALPHO.—Show how to bisect the surface of a right cone by a plane drawn parallel to the base.

(*Intermediate, 1880.*)



Let AC = s,

,, YC = x; then AY = $s - x$,

and let vertical angle of cone = 2 α.

Area of surface of cone ABC = $\frac{1}{2} \cdot 2\pi rs$

(where r = OC)

$= \pi rs$,

but OC = $s\sin\alpha$,

$\therefore$ Area of surface of cone ABC = $\pi s^2\sin\alpha$.

Similarly area of surface of cone AXY = $\pi(s-x)^2\sin\alpha$.

Area of surface of frustrum XBCY = $\frac{x}{2}(2\pi r + 2\pi r')$

$= \pi x[s\sin\alpha + (s-x)\sin\alpha]$

$= \pi x(2s - x)\sin\alpha$

$= \pi(2sx - x^2)\sin\alpha$;

but this is equal to area of surface of cone AXY.

$\therefore \pi(s-x)^2\sin\alpha = \pi(2sx - x^2)\sin\alpha$

$s^2 - 2sx + x^2 = 2sx - x^2$

$2x^2 - 4sx = -s^2$

$x^2 - 2sx + s^2 = s^2 - \frac{s^2}{2}$

$= \frac{s^2}{2}$

$x - s = \pm\frac{s}{\sqrt{2}}$,

Taking the minus sign as the only possible solution,

$\therefore x = s\left(1 - \frac{1}{\sqrt{2}}\right)$.

$= \frac{1}{2}(2 - \sqrt{2})s$.

Hence to find Y geometrically.

Produce CA to D, so that CD = 2CA.

Draw AE at right angles to AC, and join CE.

From DC cut off DG = CE, and bisect CG in Y.

Then Y shall be the point required.

Proof.—CG = CD − DG

= 2CA − CE

= 2CA − $\sqrt{2}$CA

= $(2 - \sqrt{2})$CA,

And CY = $\frac{1}{2}(2 - \sqrt{2})$CA

= $\frac{1}{2}(2 - \sqrt{2})s$. Q. E. F.

—o—

Certificate Examination, 1888.

SECOND YEAR.

Male Candidates.

Grammar and Composition.

(THREE *hours allowed for this Paper.*)

No candidate may omit the exercise in Composition. Questions 1—5, and *either* Question 6 or Question 7 may be answered, but *not both* 6 and 7.

Composition.

[N.B.—This exercise must not extend beyond this page, but it may occupy all the blank space available.]

Write in plain prose an essay on *one* of the following subjects:—

(*a*) He that has light within his own clear breast
May sit i' the centre, and enjoy bright day.

or (*b*) This was the noblest Roman of them all.

or (*c*) The character of Milton was peculiarly distinguished by loftiness of spirit.

(*b*) THIS WAS THE NOBLEST ROMAN OF THEM ALL.

This grand line occurs in the brief but powerful eulogy uttered by Mark Antony over the dead body of Brutus, at the close of the play of Julius Cæsar. The praise is all the more noteworthy as coming from one who was an adversary, and the support given to the statement in the remaining lines adds to its force and value; for Antony not only recognises that his share in the conspiracy against Cæsar had its root not in envy, but in an honest desire for the common good, but he goes on to say,

> His life was gentle, and the elements
> So mixed in him that Nature might stand up
> And say to all the world, 'This was a man.'

The character of Brutus is generally recognised as the most important in the play; and Schlegel remarks that 'Cæsar is not the hero of the piece, but Brutus.'

To understand such a character properly we must consider the circumstances in which he was placed, and the spirit in which he dealt with them. The ambitious designs of Cæsar, and the autocratic manner he had assumed, had aroused discontent among some of the leading men of Rome. These formed a conspiracy for the assassination of Cæsar, and Brutus, grieved at the misfortunes which seem to threaten the State, and influenced by the persuasion of Cassius, joins the plot.

There is nowhere the slightest ground for doubting his honourable and patriotic motives. Throughout the play we are struck by his transparent sincerity, by his intense love of his country and love of freedom, by his affectionate nature, by his trustful disposition, by his unwavering courage.

Cassius, a man of keener intellect, but less scrupulous in his conduct, recognises that to win Brutus to his side he must use different means from those that proved successful with the other conspirators. It is of no use to appeal to selfish ends. He reflects to himself—

> 'Well, Brutus, thou art noble; yet I see
> Thy honourable metal may be wrought
> From that it is disposed.'

Accordingly, he works on his patriotism and his honour. Love of Rome seemed the animating spirit of Brutus. Ligarius calls him the 'soul of Rome,' and his real feelings are shown in such expressions as these—

> 'Let the gods so speed me as I love
> The name of honour more than I fear death;'

and

> 'If it be aught toward the general good
> Set honour in one eye and death in the other
> And I will look on both indifferently.'

His affectionate nature is seen in his pathetic relations with his noble wife, Portia, in his thoughts for his page, Lucius, in his friendly regard for Cæsar, even while he thought it necessary he should die, and in the love he awakened in the people.

His trustfulness is shown in his deprecation of any need of an oath to bind men engaged in a good cause, and in his readiness to grant Antony leave to speak over the dead body of Cæsar.

His bravery appears in the fortitude with which he bore the terrible blow of Portia's death, in the calmness with which he confronts the ghost of Cæsar, in his bearing on the field of battle, and when at last he meets his fate in the resolute Roman fashion that preferred death self-inflicted to the dishonour of yielding to a foe.

Grammar and Composition.

1. Paraphrase *two* of the following passages:—

> These couchings and these lowly courtesies
> Might fire the blood of ordinary men,
> And turn pre-ordinance and first decree
> Into the law of children. Be not fond,
> To think that Cæsar bears such rebel blood
> That will be thaw'd from the true quality
> With that which melteth fools; I mean, sweet words,
> Low-crooked court'sies and base spaniel-fawning.

> Unmuffle ye faint stars, and thou fair moon,
> That wont'st to love the traveller's benison,
> Stoop thy pale visage through an amber cloud,
> And disinherit Chaos, that reigns here
> In double night of darkness and of shades.

> The abuse of greatness is, when it disjoins
> Remorse from power: and to speak truth of Cæsar,
> I have not known when his affections sway'd
> More than his reason. But 'tis a common proof
> That lowliness is young ambition's ladder,
> Whereto the climber upward turns his face;
> But when he once attains the upmost round,
> He then unto the ladder turns his back,
> Looks in the clouds, scorning the base degrees
> By which he did ascend.

(*a*) One of the common folk might have his heart softened by these bowing and cringing servilities, and so influenced he might upset the regular legal decisions as if they sprang from childish caprice. But do not be so simple as to suppose that Cæsar is so weak of heart and will as to be flattered into changing his mind as a fool might be, by mere compliments, by bending knees, or the caresses of a lap-dog.

(*b*) O stars discover your twinkling light, and beauteous moon that dost so often give bright welcome to the blessings of the traveller, unveil thy lustrous face, and send thy beams from out fair tinted clouds to chase away the spirit of blankness and disorder that pervades this realm of shadows and thick darkness.

2. Explain the following:—Cæsar's trophies—Erebus—crimson'd in thy lethe—the venom of your spleen—they rob the Hybla bees—I held Epicurus strong—like a Colossus—things unluckily charge my fantasy—dearer than Plutus' mine.

Cæsar's trophies were the spoils taken in war set up as a monument in honour of victory. The word *trophy* is from Greek *tropaion*, a trophy, from *tropē*, a turning, putting an enemy to flight, from *trĕpo*, I turn.

Erebus—A place of gloomy darkness under the earth through which souls pass to Hades. The name means darkness and is often used generally for the regions of the dead.

Crimson'd in thy lethe—made red with thy blood. *Lethe* properly means the river of the lower world from which the shades drank to obtain forgetfulness; but it is often used for oblivion, and here for death, or blood.

The venom of your spleen—the poison of your passion; formerly the spleen was regarded as the seat of the emotions, especially anger, vexation, and melancholy; hence *spleen* is used for spite, and *splenetic*, for peevish, melancholy; *venom* is from Lat. *venenum*, any liquid or juice fatal to life.

They rob the Hybla bees—they (your words) are sweet as honey taken from the bees. Hybla was a town in Sicily, famous for its honey.

I held Epicurus strong—I firmly believed the doctrines of Epicurus. The doctrines of Epicurus were that the true end of life is happiness, that this is to be attained by the practice of virtues, that the gods do not care about nor interfere in human affairs, and that there is no future state for man.

Like a Colossus—like a giant. The Colossus was a huge statue of Apollo at Rhodes; the legs extended across the harbour and ships could sail between them. Hence is derived the word *colossal*.

Things unluckily charge my fantasy—things crowd upon my fancy, fancy is from Greek *phainomai*, I appear, through Italian *fantasia*. Fancy is a further modification of the form.

Dearer than Plutus' mine—More precious than all the wealth of Plutus, the god of riches.

3. Explain *two* of the following passages, stating the circumstances under which they occur:—

> for he loves to hear
> That unicorns may be betray'd with trees,
> And bears with glasses, elephants with holes.

> This is a slight unmeritable man,
> Meet to be sent on errands: is it fit,
> The three-fold world divided, he should stand
> One of the three to share it?

> The Genius and the mortal instruments
> Are then in council.

(*a*) In course of conversation among the conspirators, Cassius suggests that superstitious fear, induced by the unaccustomed terror of the night, may keep Cæsar from the Capitol, where it is intended to kill him. Decius replies in the above words that Cæsar is fond of hearing marvellous tales and subtle flattery, and undertakes to 'give his humour the true bent' and 'bring him to the Capitol.' Unicorns were fabulous beasts with one

horn in the centre of the forehead ; the belief was that they could be caught by a person provoking them, and then running behind a tree to elude them, the result being that the horn stuck fast in the trunk of the tree, and detained the animal till the hunter could kill it. Bears, it used to be said, could be taken by means of a mirror placed in their way. While they were looking at this, the hunter had time to take a careful aim. Elephants have been captured in pitfalls lightly covered with hurdles, branches, and turf, on which some suitable bait was placed.

(*b*) 'This is a slight unmeritable man,' &c. In these lines Antony expresses to Octavius his opinion of Lepidus, the third of the triumvirate who ruled Rome after the fall of Cæsar. 'Unmeritable' is used in a peculiar way for unworthy, without merit. 'Meet to be sent on errands' means that he is fit for nothing better than to execute the commissions of others. If the world of the Romans is to be divided among three persons, Antony questions whether Lepidus is fit to be one of the three.

(*c*) 'The Genius and the mortal instruments are then in council.'

These words occur in a short soliloquy in which Brutus reflects on the nature of the conspiracy into which he has entered. The Genius may be understood as the tutelary spirit who watches over a person's actions. Shakespeare uses in this sense the words 'angel' and 'demon' also. The mortal instruments are the natural faculties and passions. The sentence seems to mean that before carrying some dreadful thought into action there is a time when the guardian spirit and the human powers are in a ferment of controversy. It is analogous to the figure of the 'conscience striving amid the warring senses.'

4. Explain *six* of the following :—

Who knows not Circe—dark-veil'd Cotytto—Scylla wept—that snaky-headed Gorgon shield—he called it hæmony—the Cynic tub—the soothest shepherd that e'er pip't on plains—We cannot look upon the sportive exercises for which the genius of Milton *ungirds* itself, without catching a glimpse of the *gorgeous* and terrible *panoply* which it is accustomed to wear.

(*a*) *Who knows not Circe*—Circe was the daughter of Helios, the Sun. She is fabled to have had magic powers, and to have turned into swine persons who drank of a cup she offered them. According to Milton she is the mother of Comus, the god of riotous mirth.

(*b*) *Dark-veil'd Cotytto*—A Thracian goddess, whose festival was celebrated at night with abominable rites, which it was forbidden to reveal.

(*c*) *Scylla wept*—Scylla was a fabled monster who barked like a dog, and dwelt in a cave on the island rock, also called Scylla, on the south-west coast of Italy.

(*d*) *That snaky-headed Gorgon shield*—Medusa, one of the three terrible monsters known as the Gorgons, was mortal. Perseus having cut off her head, presented it to Minerva, who wore it in her shield or breast plate. The head of the Gorgon was covered with clustering snakes.

(*e*) *He called it hæmony*—This name for a magical plant was probably coined by Milton from Hæmonia, a name for Thessaly, a division of Greece famous for magical arts.

(*f*) *The Cynic tub*—The tradition is that Diogenes, the Cynic philosopher, adopted a tub as his home. *Cynic* is from Greek *kunikos*, like a dog, from *kuon*, a dog.

(*g*) *The soothest shepherd that e'er pip't on plains*—This is applied to Melibœus, one of the shepherds in Virgil's first eclogue—*soothest* means truest.

(*h*) *We cannot look, &c.*—This means that in Milton's lighter poems we see something of the richness of his fancy, the abundance of his learning, and the loftiness of his diction. *Ungirds* means takes off the girdle ; *gorgeous* means showy, splendid, and is derived from old Fr. *gorgias*, beautiful, a word which also meant a ruff, and neck-armour, like *gorget ; panoply* means complete armour, from Greek *panoplia, pas*, all, and *hoplon*, a tool, *hopla*, arms. The use of these words suggests the old contests of the athletes and warriors, and makes the whole sentence consistently metaphorical.

5. Explain the following passages, stating the circumstances under which they occur :—

I had rather be a dog, and bay the moon,
Than such a Roman.

Whilom she was the daughter of Locrine.

Amidst these that fair Muse was placed, like the chaste lady of the Masque, lofty, spotless, and serene, to be chattered at, and pointed at, and grinned at, by the whole rout of Satyrs and Goblins.

(*a*) I should prefer being a dog and barking at the moon to being a Roman who would accept a bribe. The howling noise made by dogs at night is supposed to be barking at the moon. The sentence occurs in a speech of Brutus in the famous quarrel scene with Cassius.

(*b*) *Whilom she was the daughter of Locrine.*—Locrine, a legendary king of England, divorced his wife Guendolen to marry Estrildis. By the latter he had a daughter, Sabrina, who by the vengeance of the first wife was drowned in the river which commemorates her name—the Severn. *Whilom* means formerly : it is the A.-S. *hwilum*, dative plural of *hwil*, a time. The sentence is part of the speech of the Spirit telling the tale of the Severn.

(*c*) *Amidst these that fair Muse was placed, &c.*—In this sentence Macaulay uses a very apt simile, based on Comus, to describe the relation of the poet Milton to the verse-writers of the Restoration. Having just described the latter as licentious and venal scribblers in favour with the sovereign and the public, and compared them to the loathsome rabble of Comus, grotesque monsters, half bestial, half human, he goes on to compare the pure spirit which dwells in Milton's poetry to the chaste Lady of the Masque placed in the midst of a rabble of satyrs and goblins who make her their sport.

Muse means here the spirit or presiding genius of poetry. *Masque* is a form of drama composed for a special occasion, and represented with music, scenery, and other embellishments. *Rout* means a crowd, a disorderly rabble, from old Fr. *route*, probably connected with *rumpo*, I break ; *ruptus*, broken. *Satyrs* were sylvan deities, represented as part man, part beast, and very wanton. *Goblins* were evil spirits, from Fr. *goblin*, Gr. *kobalos*, a mischievous spirit.

6. Take one of the following statements, and explain briefly how Lord Macaulay proceeds to justify it :—

(*a*) The spirits of Milton are unlike those of almost all other writers. (*b*) The character of Milton was peculiarly distinguished by loftiness of spirit. (*c*) His public conduct was such as was to be expected from a man of a spirit so high and of an intellect so powerful.

(*a*) In support of his statement that the spirits of Milton are unlike those of almost all other writers, Macaulay points out that they are not merely wicked men, nor metaphysical abstractions, nor ugly beasts. They are not endowed with grotesque peculiarities like the creations of Tasso and Klopstock. Their forms are vaguely described, and their characters are sufficiently human for human beings to understand them. It is in their vagueness that they especially differ from the spirits of Dante, whose descriptions abound in picturesque but realistic details. Milton is mysterious as well as picturesque in his representations of the supernatural. Dante is picturesque without mystery. A further comparison is made, in which Milton's spirits are said to resemble rather the gods and demons of Aeschylus.

(*b*) Macaulay justifies the opinion that the character of Milton was peculiarly distinguished by loftiness of spirit, by reference to the way in which he bore himself in his later days 'when he had survived his health and sight, the comforts of his home, and the prosperity of his party.' His early friends were either dead, exiled or imprisoned. Writers of the lowest character were in high favour. Sick, blind, and poor, disappointed, neglected, abused, Milton might have been excused for despondency and asperity. But Macaulay says, 'the strength of his mind overcame every calamity.' All his misfortunes were powerless to disturb his sedate and majestic patience, or to render his serious temper sullen or fretful. His temper seems to have been the same in the time of his greatest calamity as in the glowing hopeful time of his early manhood. The poems of his old age exhibit the same noble characteristics as those of his youth, only with maturer thought and style. The sonnets, which are nearly all of a personal character, are dignified, sober, and noble expressions of genuine natural feeling.

Macaulay treats his public conduct at great length, and introduces arguments on the action of the Commonwealth party to justify Milton's defence of the regicides.

7. Lord Macaulay, referring to the mark of national respect paid in our own time to Addison, says :—'It was due, above all, to the great satirist, who alone knew how to use ridicule without abusing it, who, without inflicting a wound, effected a great social reform, and who reconciled wit and virtue, after a long and disastrous separation, during which wit had been led astray by profligacy, and virtue by fanaticism.' Comment on this passage.

The mark of national respect referred to was the erection of a statue of Addison in Poet's Corner in 1809. Addison had died in 1719, and his body, after lying in state in the Jerusalem

Chamber, had been placed in the vault of the House of Albemarle, on the north side of the chapel of Henry the Seventh. The solemn occasion is impressively described by Macaulay, who further reflects on the absence of any monument in the Abbey till ninety years after. In Macaulay's essay the satire of Addison is compared and contrasted with that of Voltaire and of Swift. It was specially marked by good humour, good nature, and good breeding. Addison, in his satire, was neither a cynic nor a buffoon. But his highest attributes were the grace, the nobleness, the moral purity that distinguished his merriment from that of almost all the other masters of ridicule. His satirical papers appeared chiefly in the Tatler, the Spectator, and the Guardian. Most of these can still be read with extreme pleasure, and the reading justifies the opinions expressed by Macaulay. Addison appears to have been a modest, simple-minded and consistent Christian, and in this character he was able to effect the reconciliation between wit and virtue, which had been separated from the time of the Restoration. The wittiest writers after the Commonwealth had been notorious for their licentiousness, and the Puritans had adopted an unlovely austerity which excluded almost every form of recreation, however simple and harmless.

SECOND YEAR.

Female Candidates.

Grammar and Composition.

THREE *hours allowed for this Paper.*

No candidate must omit Question 1 or 2, or answer more than SIX other questions.

COMPOSITION.

N.B.—This exercise must not extend beyond this page, but it may occupy all the blank space available.

1. Write in plain language an essay on *one* of the following topics :—

(*a*) The influence of the electric telegraph on politics and social life.

(*b*) The Historical Novel.

(*c*) 'There is a tide in the affairs of men,
Which, taken at the flood, leads on to fortune.'

(*b*) An essay on The Historical Novel appears in the PRACTICAL TEACHER for December last.

GRAMMAR.

2. Paraphrase *one* of the following passages, and explain fully the connection in which it stands :—

(*a*)

I could be well moved if I were as you ;
If I could pray to move, prayers would move me ;
But I am constant as the northern star,
Of whose true fixed and resting quality
There is no fellow in the firmament :
The skies are painted with unnumbered sparks—
They are all fire, and every one doth shine ;
But there's but one in all doth hold his place.
So in the world, 'tis furnished well with men,
And men are flesh and blood, and apprehensive ;
Yet in the number, I do know but one
That unassailable holds on his rank
Unshaked of motion ; and that I am he.
Let me a little show it even in this ;
That I was constant Cimber should be banished,
And constant do remain to keep him so.

(*b*)

Is Brutus sick, and is it physical
To walk unbraced and suck up the humours
Of the dank morning? What, is Brutus sick,
And will he steal out of his wholesome bed,
To dare the vile contagion of the night?
And tempt the rheumy and unpurged air
To add unto his sickness? No, my Brutus,
You have some sick offence within your mind,
Which by the right and virtue of my place,
I ought to know of : and upon my knees
I charm you, by my once commended beauty,
By all your vows of love, and that great vow
Which did incorporate and make us one,
That you unfold to me, yourself, your half,
Why you are heavy, and what men to-night
Have had resort to you ; for here have been
Some six or seven, who did hide their faces
Even from darkness.

(*a*) If I were an ordinary mortal like yourself, Cassius, I might be persuaded. If I could beg of others I might be moved by their petitions. But I am like the pole-star fixed in its place, in this respect alone among the stars of heaven that it remains always immovable. Innumerable stars bespangle the sky ; all are shining orbs of fire ; but only one of all the host keeps ever in its place. It is so with the men who inhabit this world. There are many of them ; they are sentient and intelligent beings. But of all the multitude ; I know of only one that maintains his dignity unmoved by any outward influence. Let me give some slight proof that I am this constant one, by my answer to this suit. I resolved on the banishment of Cimber ; my will is now that his banishment shall continue.

(*b*) Are you ill, Brutus? and do you think it well to walk thus in the damp morning air so slightly clad? Should you, when sick, leave your comfortable bed, and run the risk of breathing the unwholesome vapours of the night? Is it not likely that the moist air may be laden with contagion that may increase your ailment? Nay, dear Brutus, it is your mind that suffers from some trouble, which my position as your wife entitles me to know of. See, I kneel and beg of you by my personal graces, which you used to praise, by the promises of your wooing, and by that solemn contract which bound and binds us still together, that you tell me, your wife, your other self, the reason of your anxious thought. Tell me who are those men who came to visit you to night ; for six or seven have been here, and even in the gloom of night they thought it well to veil their faces.

(3) Give briefly such explanation as would be necessary to scholars in the Sixth Standard respecting the meaning and force of the following expressions :—

'You must *conceit* me.' 'Crimsoned in thy *lethe*.' 'The *ides* of March.' 'Be *factious* for redress of all these *griefs*.'

'Yon grey lines
That *fret* the sky, are messengers of day.'

'The persuasion of his *augurers*.' 'Senators, of praetors, and common *suitors*.'

(*a*) You must *conceit* me.— You must judge of me. *Conceit* is here used as a verb with almost the same meaning as *conceive*, or *conceive of*.

(*b*) Crimsoned in thy *lethe*.— Made red with thy blood. *Lethe*, from the Greek *lethe*, forgetfulness, also the river of oblivion, came to be applied figuratively for *death*, and then for blood or the shedding of blood.

(*c*) The *ides* of March.— According to the Roman way of reckoning time, each month had three days distinguished by special names, Kalends, Nones, Ides. The ides was the thirteenth except in March, May, July, and October, when it was the fifteenth. The ides of March, therefore, means the fifteenth of March.

(*d*) Be *factious* for redress of all these *griefs*—Form a faction or party for redress of all these grievances. *Factious* from faction, a party for doing something, is derived from Lat. *facere*, to do. *Griefs*, usually meaning sorrows or causes of sorrow, here means *grievances*, or causes of dissatisfaction ; both words are derived from Lat. *gravis*, heavy, burdensome.

(*e*) Yon grey lines
That *fret* the sky are messengers of day.

Those grey lines yonder that adorn the sky are signs of day-break. *Fret*, means to ornament or variegate, from A.-S. *fraetwan*, to adorn. This word is particularly used of carved work.

(*f*) The persuasion of his *augurers*.—The advice of his soothsayers. *Augurers*, of which the Latin form was *augurs*, means those who professed to foretell events from the flight of birds, or the entrails of animals, or the heavenly bodies. The word is derived from *avis*, a bird.

(*g*) Senators, of praetors, and common *suitors*. *Senators* were the elders who formed the Senate of Rome ; *praetors* were officers of the Republic, next to the consuls. Cæsar raised the number to sixteen. *Suitors* are those who had petitions to present. The word is derived from *sequor*, I follow, *secutus*, followed. A suit is something sought or asked for.

(4) Point out any grammatical peculiarities in the following extracts and explain them :—

'Would he were fatter.' 'That must we also.'
'Think ye, I am no stronger than my sex,
Being so fathered and so husbanded?'
'It were a mock
Apt to be rendered.'
'I may do that I shall be sorry for.'

(*a*) There is an ellipsis of the pronoun *I* before would, *would* is used in the sense of *wish*. *Were* is in the subjunctive mood. The whole means I wish, I should prefer that he were fatter.

(*b*) 'That must we also' means, we must do that also. The peculiarities in this sentence are the inversion of subject and object for emphasis, and the ellipsis of the verb *do* for brevity.

(*c*) Here there is an ellipsis after than, (others of) my sex; *fathered* and *husbanded* are examples of nouns treated as verbs. Portia is referring to the noble character of her father Cato, and her husband Brutus.

(*d*) *It were* is a subjunctive form for 'It would be.' Mock, usually a verb, is here a noun, meaning sarcasm or jibe. The whole sentence means—It would be a sarcasm likely to be made or repeated.

(*e*) *That* was formerly used for *what*, that which. I may do what I shall be sorry for.

(5) Analyse this sentence—

I cannot tell what you and other men
Think of this life, but for my single self
I had as lief not be, as live to be
In awe of such a thing as I myself.

Comment on the different senses in which the word 'be' is used in this passage.

Clause.	Kind of Clause.	Subject.	Predicate.	Object.	Extension of Predicate.
(*a*) I cannot tell	Principal	I	cannot tell	Clause (*b*)	
(*b*) What you and other men think of this life	Noun clause subordinate to (*a*) object	you and other men	think	what	of this life
(*c*) [But] for my single self I had as lief not be	Principal adversative to (*a*)	*But* I, for my single self	had [would] be	...	not (negation) as lief (manner)
(*d*) As [I would] live to be in awe of such a thing	Subordinate adverbial to (*c*) comparison	*As* [I]	[would] live	...	to be in awe of such a thing [circumstance]
(*e*) As I myself [am]	Subord. adj. to *thing*	*As* I myself	am		

In the first place *be* is used for live, exist; in the second it is used in the same sense as the copulative verb, and is completed by the phrase *in awe*, &c.

(6) Of whom are the following sentences spoken, and by whom? Take one of the characters referred to, and describe it in detail—

(*a*) 'This is a slight unmeritable man,
Meet to be sent on errands.'
(*b*) 'He will never follow anything
That other men begin.'
(*c*) 'He thinks too much—such men are dangerous.'
(*d*) 'This was the noblest Roman of them all.'
(*e*) 'What a blunt fellow is this grown to be.'
(*f*) 'He doth bestride the narrow world
Like a Colossus.'
(*g*) 'He sits high in all the people's hearts.'

(*a*) This is said of Lepidus by Mark Antony.
(*b*) Said of Cicero by Brutus.
(*c*) Refers to Cassius, and is spoken by Cæsar.
(*d*) Said of Brutus by Antony.
(*e*) Said of Casca by Brutus.
(*f*) Refers to Cæsar by Cassius.
(*g*) Said of Brutus by Casca.

The character of Brutus is described in detail in an essay on the quotation, 'This was the noblest Roman of them all' in the Answers to Paper for Male Candidates.

(*c*) Cassius was practically the head of the conspirators. He is somewhat fully described by Cæsar in the scene from which the above sentence is taken. He is represented as a spare man, eager looking, thoughtful, a great observer, caring nothing for amusements, and seldom smiling. Cæsar regards him as a dangerous man, and, though he will hardly admit it, is afraid of him. For this there is undoubtedly no lack of reason. Cassius is an artful plotter, as shown by the way in which he prevails on Brutus to join in the conspiracy. He is frankly envious of Cæsar, and indignant at his greatness, as appears in the speeches by which he seeks to work upon Brutus. He is very thorough-going in regard to the plot, and wishes to kill Antony as well as Cæsar, being somewhat unwillingly dissuaded by the more scrupulous Brutus. His craft and knowledge of the world make him distrustful, and he shows a hasty temper. He has some good qualities, as shown in his friendship for Brutus, and proved by the good opinion of the latter who laments him in the words—

The last of all the Romans, fare thee well!
It is impossible that ever Rome
Should breed thy fellow.

Professor Dowden says of Cassius, 'He is not ignoble. Brutus loves him, and the love of Brutus is a patent which establishes a man's nobility. And Cassius has one who will die for him. Titinius crowns the dead brow of the conspirator.'

(7) 'The manner of Addison is as remote from that of Swift as from that of Voltaire.' Explain and amplify this statement of Macaulay's.

Macaulay regards Addison, Swift and Voltaire as the three greatest masters of the art of ridicule in the eighteenth century. Which of them had the greater power may be questioned, but each was supreme in his own domain. Voltaire was the prince of buffoons. His merriment is unrestrained. There is nothing which he venerates, and there is no measure in his mockery. He is always keen, often coarse and heartless.

Swift was a misanthrope, and his wit and humour, though they provoked laughter, were sour and bitter, and his satire wounded and rankled. There was no light-heartedness about his mirth, and his jests were sometimes brutally cynical.

Addison was unlike each of these famous satirists. In his wit there was not the harshness of Swift, nor the buffoonery of Voltaire. He was pleasant in his mirth, and never either coarse or malignant. He seems to have overflowed with good humour, and had such reverence for all that was pure and good that he never associated anything noble with a degrading idea. Macaulay says he never blackened any man's character, and it would be difficult to find in his works a single taunt which can be called ungenerous or unkind.

(8) Whence did Shakespeare obtain the material for the play of Julius Cæsar? Give instances showing in what way he used this material, and what additions he made to it.

There can be no doubt that Shakespeare based his tragedy of Julius Cæsar on North's translation of Plutarch's Lives of Cæsar, Brutus and Antony. Not only the incidents, but many words and expressions are taken direct from Plutarch. Archbishop Trench indeed says, 'It is hardly an exaggeration to say that the whole play is to be found in Plutarch.' But he goes on to say that 'Shakespeare has thrown a rich mantle of poetry over all, which is often wholly his own.'

The way in which the dramatist uses his material is admirably shown in the reasonings and remonstrances of Portia with Brutus, where a quaintly worded narrative is cast into most effective dramatic form. Again, Plutarch's characterisation of Cassius as 'choleric,' and hating Cæsar privately, is worked out through the play in a masterly manner. The same may be said of the treatment of the greatest character of the play.

The speeches of Brutus and Antony over the dead body of Cæsar are not in Plutarch; so they are Shakespeare's own, though he may have obtained hints for them from Appian's *Civil Wars*, of which an English translation had been published in Elizabeth's reign. Antony's eulogy on Brutus may have been suggested by a passage in Cynthia's Revels, by Ben Jonson; though it is possible that Jonson borrowed from Shakespeare.

The expression *Et tu Brute!* is not from Plutarch; but may have been introduced from a Latin play on the same subject, which is lost.

(9) At what period in the history of Rome does the action of the play begin; and what events had just taken place which explain the opening scene of the drama.

Give the historical facts and dates referred to in these passages—

(*a*) 'You and I have heard our father say
There was a Brutus once.'

(*b*) 'Many a time and oft
Have you climbed up to walls and battlements,
* * * *
To see great Pompey pace the streets of Rome.'

(*c*) 'They mean to warn us at Philippi here.'

(*d*) 'On the Lupercal
I thrice presented him a kingly crown.'

The date of the feast of Lupercalia, which takes place at the opening of the play, was February, 44 B.C. Cæsar had just returned from Spain, where he had defeated the sons of Pompey in the battle of Munda. According to the Roman custom, Cæsar made a triumphal progress through the city to celebrate his victory, and the citizens whom Flavius and Marullus reprove for idleness were in the streets to see the procession. The triumph was actually celebrated in October, 45 B.C., not at the feast of Lupercalia.

(*a*) Early in the 5th century, B.C., according to legendary history, lived Lucius Junius Brutus, who expelled the Tarquins, abolished the Monarchy, and established the Republic. He is said to have condemned his own sons to death for attempting to restore the Monarchy.

(*b*) Pompey, who was born in 106 B.C., was one of the first triumvirate, B.C. 59, Cæsar and Crassus being the other two. He had made himself famous by many victories in Africa, Spain and the East, and it was to some of the triumphs in celebration of these victories that Marullus referred. After a time the fortunes of Pompey declined while those of Cæsar rose, and they became rivals. Pompey at last was murdered in Egypt, B.C. 48.

(*c*) Philippi was a city in the east of Macedonia, and was founded by Philip, father of Alexander the Great. Two battles were fought at Philippi, in 42 B.C. The second, in which Brutus fell, took place about 20 days after the first. Shakespeare makes the two engagements happen on the same day.

(*d*) The feast of Lupercal, or Lupercalia, was celebrated on the 15th of February, in honour of Lupercus, the god of fertility. The offering of the crown by Antony is narrated by Plutarch, and the narration is closely imitated in the account given by Casca in the first act of the play.

(10) Give the substance of Macaulay's observations on *one* of these subjects: (1) Addison's scholarship; (2) his political life; (3) his friends and acquaintances; or (4) his influence on English Literature.

1. Addison had the reputation at Oxford of being a very accomplished scholar. Macaulay thinks his attainments have been somewhat overrated. But in one branch—the knowledge of the Latin poets—his proficiency was such as it is hardly possible to overrate. He not only understood the Roman poets but could imitate them with skill almost unsurpassed. His classical scholarship seems to have been almost confined to the poets, for he rarely refers in his works to the moral and political writers of Rome. His knowledge of Greek may have been thought respectable at the time, but was not such as would satisfy the requirements of the present. In support of his opinion Macaulay notices the absence of references to Greek writers in the notes he appended to his translations from Ovid, in his book of Travels in Italy, and his Treatise on Medals. These works afforded special opportunities for quotations from the Latin prose writers, and Greek authors.

Notwithstanding this criticism Macaulay thinks Addison's classical acquirements served him as well as if they had been more extensive. For knowing thoroughly what most scholars knew in some degree, his work was better appreciated than it would have been if he had been able to do what no one else, or very few, would attempt. His Latin poems, marked by purity of style and an easy flow of numbers, were greatly and justly admired, both at Oxford and Cambridge.

How to Teach School Children to Sing from the Staff Notation.

BY W. G. McNAUGHT,

Associate of The Royal Academy of Music.

11. The musical facts to be conquered at this stage are the singing of the tones of the Doh chord in *any* order of succession and stepwise movement to and from the other tones of the scale. These facts can be introduced simultaneously with the staff but it is much safer to teach them from a tonic sol-fa modulator, or at least from a column of sol-fa syllables written on the blackboard. A mnemonic association has to be established between a certain syllable and a certain scale-tone effect, not between a certain line or space and an effect. The note on the line or the space must be discovered to be **doh** or **soh**, etc., before its sound is suggested to the mind's ear. It is true that the rise and fall of notes on the staff is most suggestive of the rise and fall of tones in pitch. But it is the fault of this virtue of the staff notation that pupils are strongly tempted to rely solely upon this delusive suggestiveness. It works very well for contiguous notes and small leaps, but when even good pupils attempt to sing wide leaps by a rough estimate of their distance the result is most often a failure. The teacher should therefore relentlessly insist upon each note on the staff being correctly sol-faad according to its place in the scale.

12. The first and by far the most important task is to impress the ears of pupils with the varied effects of the scale tones irrespective of the pitch of the key tone, and to attach to these effects the syllabic sol-fa name. Do not begin by going up and down the scale. Such an introduction to the scale tones will render difficult one of the easiest of successions, viz., the tones of the Doh chord. Begin by teaching the Doh chord and gradually add the other tones as pendants. Divide the scale into little fragments, each of which will bring out the peculiar effect of some one tone. Teach leaps not by calling attention to the interval or distance (this should be taught at a much later stage), but by calling attention to the peculiar effect of the tone to which the leap is to be made.

13. The apparatus indispensable is a blackboard ruled with music lines. Red lines are better than white because they show up the white chalk. The lines in each stave should be at least an inch and a quarter apart. Besides this the class should have, if possible, Curwen's Staff Notation Charts (*a*). These are somewhat expensive, but they are so admirably printed, and the exercises are so well arranged, that their use quickly saves in time much more than their cost in money. Bright-coloured chalk will be found useful when attention is directed to some new point. Great use can be made of the fingers of the left hand by using them as a representation of the staff, and

(*a*) Price 18s.

pointing with a thin pointer held in the right hand. For a class book, 'Crotchets and Quavers,' Part I. (*b*), will be found useful and cheap. All the earlier exercises duplicate those on the charts. A great advantage is gained when an exercise thoroughly taught from the blackboard or charts can be practised from the necessarily small notes in the book.

THE DOH CHORD.

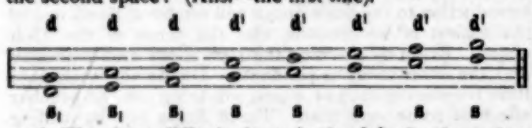
14. The stave of five lines should be used at first simply to show the steps of the scale or the notes of the chord. No attempt should be made to teach the alphabetical pitch names (C, D, E), or the meaning of a clef.

For convenience of reference the lines and spaces should be numbered as follows :—

5th	Line	4th	Space
4th	,,	3rd	,,
3rd	,,	2nd	,,
2nd	,,	1st	,,
1st	,,		

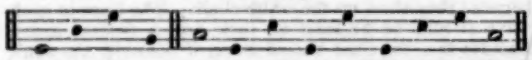
The view that the key of C is the 'natural' key, and that all other keys involve so many alterations of 'natural' tones that must be shown by the flats or sharps of a signature, should be deferred for gradual exposition according to the mental capacity of the class. Meantime, skill in quickly hitting the tones of the chord, and readiness in recognising the notes on the staff, should be cultivated. Establish the fact that if **doh** is on a line **me** and **soh** must follow on successive lines above, and if **doh** is in a space **me** and **soh** must similarly fall in the spaces. Begin with **doh** on the first line, then on the second line and then on the third line. When leger lines have been explained the **doh** should be placed on the first below the staff. Then in turn place the **doh** in the space below the first line, in the first space and in the second space. In writing on the board **doh** should be written in red or some other bright colour, the other notes being shown with ordinary white chalk. It is not important at present to go out of the way to fix the pitch of each of the **dohs** exactly in accordance with the pitches shown if there were a treble clef. But it will be as well to roughly approximate the treble clef pitches.

15. When **doh, me** and **soh** can be easily read and sung, the relative positions of upper **doh** and lower **soh** must be carefully taught. The frequency with which the succession **doh me soh** is followed by upper **doh**, and the tone **doh** by lower **soh**, will lead to the expectation that these tones will follow on the line or space next above or below. The class must therefore be well drilled to see that if **soh** is on a line the **doh** above must be in a space, and if **doh** is on a line the **soh** below must be in a space. Questions as follows should be frequent :—'Where will high **doh** be when **soh** is on the third line?' (Ans.—the fourth space) or 'Where will low **soh** be when **doh** is in the second space?' (Ans.—the first line).



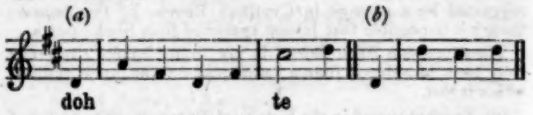
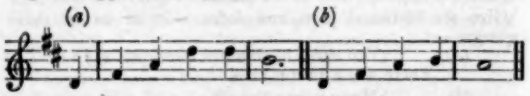
16. The most difficults leaps in the **doh** chord are that from **doh'** (upper **doh**) to **me** or when the range of an exercise is from **soh,** (lower **soh**) to middle **soh**, that from **soh,** to **me**, and that from **soh** to **doh**.

Doh 1st line. Doh 2nd space.



Practical exercises without notation should be frequently given. Sing **doh soh** or **doh doh'** and ask the class for the **me**. Sing **doh me** and ask for the low **soh**. Write a long exercise on the board and ask some of the class to sing the **dohs**, some the **mes**, some the **sohs**. Give frequent ear exercises on the tones of the chord in any order.

(*b*) Curwen, price 3d.

17. The other tones of the scale should be impressed on the ear by drawing attention in the most prominent manner to their peculiar effects and tendencies. The general effect of the four remaining tones, viz., **ray, fah, lah,** and **te,** is expectancy or restlessness. They are most easily sung—except perhaps in the case of **te**—from the tone of the **doh** chord next above or below. But their peculiar or special mental effects are most strikingly brought out by leaps. Thus the keen brightness of **te** is more easily felt in such a phrase as (*a*) than by such an approach as (*b*)

and the melancholy of **lah** by the leap in (*a*) than by the stepwise approach in (*b*).

But inexperienced children should not be expected to freely sing at sight passages involving wide leaps of this kind. They can be easily taught to sing stepwise movements. Therefore, these should form the chief part of their sight-singing practice, and they should be expected to sing the leaps only after a pattern from the teacher. As skill advances the leaps should be systematically classified and taught. The hand signs of the Tonic Sol-fa method will be found prominently useful at this stage. Their suggestiveness is so strong that pupils are often able to think of a scale effect by their use when all other means of stimulating conceptions of tones have failed. These signs are explained in nearly all the Tonic Sol-fa text books.

(To be continued.)

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Science Notes.

THE reports of the examiners on the result of the Science examinations of the South Kensington department have been published and circulated. Some of them are short and general. Others deal with the answers in detail and offer observations which are likely to prove useful. The papers in Practical Plane and Solid Geometry are said to be below the average. If we understand the wording of the report, a large number of candidates passed who exhibited no real knowledge of the subject. This sounds strange. We greatly doubt whether teachers would thank the examiners for passing candidates who exhibit no real knowledge of the subject. The examiner goes on to say that there are no grounds for believing that the paper was too difficult. It would be interesting to know how that conclusion was arrived at. Were a number of experienced teachers consulted, or did the examiners decide the matter by putting down their own opinions about it? We have the more doubt about the matter, because they go on to say that there is no ground whatever for thinking that the unfortunate mistake in question 7 affected the result. Perhaps not. But certainly the reasoning of the examiner does not prove it. There are far too many of these misprints. In a paper in Chemistry, set last Christmas by the Science and Art Department, candidates were

asked to express the volume of a certain number of grains of Hydrogen, a calculation which, in all probability the examiner could not have done himself. It is easy to say these mistakes are obvious. They may be so to the superior persons who make them; but to candidates, who are already nervous and excited, examiners' errors are very serious obstacles. Candidates will read and re-read a question a dozen times; they will try it, correct it, and finally cross their answer out in despair and then, having wasted an hour and lost their self-command, fail to do themselves justice in every other question they attempt. We make no complaint in regard to the severity of the report. We can only say that after the remarks the examiners have made, if the papers sent in next year justify the impressions they have previously formed, we hope they will take care that no candidate passes who shows no real knowledge of the subject.

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The report in Mathematics, Stages 1, 2 and 3, is well worth attention. One most useful remark that should not pass unnoticed is the almost universal weakness pupils show in substituting figures for symbols in algebraical formulæ. The results are frequently wrong, and where they are numerically right, they have the wrong signs prefixed. We venture to think, the examiner would have agreed with us in suggesting that a free use of brackets and a fuller working would go far to secure greater accuracy. Pupils try to take too many steps at once. The papers in Theoretical Mechanics are favourably reported upon, the criticisms being very full and suggestive.

The advanced and the honours papers were well done; the elementary questions fell below the average; most likely because the type of question was altered: alterations may be imperative, but ought they not to be introduced gradually?

There is no report upon the papers set in Acoutsics, Light, and Heat. This is to be regretted. Considerable disappointment was expressed in regard to the questions set. It would have been interesting and perhaps instructive to have had the examiners' views of them. In regard to the points involved, would it not be well if all pupils who take examinations in Physical Science, should be expected to understand and use the C. G. S. system of units. Surely they are almost the A. B. C. of modern measurement. If the examining bodies of the country would insist upon using them for, say, ten years, the general opinion of the country would be entirely in favour of retaining them.

There is the usual painstaking and detailed account of the papers in Physiology and Botany, occupying above 12 pages.

It is gratifying to read that 'the answers from the good schools show a most creditable amount of good, honest, intelligent, and in some cases, really able teaching, and the pupils have certainly in many cases, acquired a sound knowledge of elementary physiology.' Professor Foster goes on to say, 'every teacher who is instructing an advanced class ought to have at his command a thoroughly good microscope of sound defining power, with a magnification of 400 diameters at least. He ought to be able to prepare himself sections of tissues and organs, and other microscopical objects, having recourse to purchased specimens in special cases only. He ought to make each of his pupils examine under the microscope, and as far as possible, thoroughly understand, preparations of the principal animal tissues. The acquisition of the microscope is an expense, especially if a class being large and at the same time limited, more than one microscope is necessary, but beyond this the expenditure of money is insignificant, though that of time is greater than in cases where the teaching is limited to the use of diagrams and pictures.' Reports embodying such excellent advice as this cannot but be useful reading.

The papers in Agriculture in the elementary stage were not quite satisfactory: those in the advanced stage were more so. Complaint is made of the illiterate character of the papers. This is not to be unexpected if instruction in agriculture is being given to those who most need it. It has been urged again and again that boys in the country should know more of farming and less of spelling. If, therefore, they only show some grip of the subject, excuse should be made for their inelegant and illiterate expressions.

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How my School was Examined.

BY THE HEAD MASTER OF A LONDON SCHOOL.

Standard I.

Arithmetic.—The boys having been divided into two sets, alternately A and B, the following sums were dictated:—

A. 1. Add 9; 580; 607; 94; 563.
2. From 902 take 106.
3. Take 36 from 743.
B. 1. Add 9; 580; 607; 94; 653.
2. From 902 take 107.
3. Take 63 from 743.

Answers.—*A.* (1) 1853; (2) 796; (3) 707.
B. (1) 1,943; (2) 795; (3) 680.

Writing.—The following ten words were dictated, each to begin with a capital letter:—

Black, Birds, Grass, Summer, Floor, Nails, Teacher, Chalk, Water, Boat.

Geography.—Questions on the plan of the school, and the direction of neighbouring streets and places were asked by the teacher of the class.

English.—Each boy had to repeat a portion of the passage prepared, and the teacher examined on the meaning.

Standard II.

Arithmetic.—Here, as in Standard I., alternate boys were lettered A and B, and two sets of sums were dictated.

A. 1. 7,894 ÷ 8.
2. 6,975 × 790.
3. 59,786 × 36.
4. 17,007 − 6,098.
B. 1. 7,894 ÷ 9.
2. 6,975 × 608.
3. 59,786 × 54.
4. 17,007 − 10,010.

Answers.—*A.* (1) 986 + 6 over; (2) 5,410,250; (3) 2,152,296; (4) 10,909.
B. (1) 877 + 1 over; (2) 4,240,800; (3) 3,228,444; (4) 6,997.

Dictation.—The following passage was dictated from the New Royal Reader, page 74.

'One of the sailors lifted up his oar, and, striking this bear a terrible blow on the head, drove him back into the water. This, however, did not seem to hurt him much, as he was soon swimming about again with his companions.'

English.—After the poetry had been recited, the Inspector asked questions on the meaning, and required the boys to pick out nouns and verbs from different passages.

Geography.—Questions were asked on peninsula, lake, continent, and isthmus, and the map of England was used to illustrate definitions.

STANDARD III.

Arithmetic.—Specimen cards:—

A. 1. Find the sum of £8 17s. 10½d. + £48,609 0s. 11d. + £9,847 15s. 9½d. + £69 8s. 0¾d. + £849 16s. 11½d.

2. Find the difference between nine hundred and ninety pounds six shillings and three farthings and eight thousand and one pounds.

3. Divide three hundred and sixty-one thousand four hundred by eighty-nine.

4. Twenty-nine bags contain 365 nuts each; 278 were taken out of each bag. How many are left altogether?

B. 1. From seventy thousand and six pounds sixteen shillings and sixpence take three thousand seven hundred and nine pounds eighteen shillings and sevenpence farthing.

2. Find the total amount of £17 16s. 6½d.; £9,060 18s. 7d.; £795 14s. 8¾d.; £37,676 19s. 11¼d.; £95,808 8s. 4¾d.

3. Multiply fifty-six thousand seven hundred and thirty-six by eight hundred and seven.

4. A farmer had £100. He bought a horse for £31 10s., and a cart for £12 10s. What was left?

Answers.—*A.* (1) £59,384 19s. 7¼d.; (2) 7,010 13s. 11½d.; (3) 4,060 + 60 over; (4) 2,523 nuts.

B. (1) £66,296 17s. 10¾d.; (2) £143,359 18s. 2¼d.; (3) 45,785,952; (4) £56.

Dictation.—The following passage was dictated from Longmans' New Reader, page 78:—

'At last the day dawned; still he could find neither the dog, which he trusted so much, nor any of the lambs.

'He felt there was nothing else he could do, so he made up his mind to return, and tell his master that all the lambs were lost—that he did not know what had become of one of them.'

English.—The poetry prepared was repeated simultaneously by the class, and then each boy repeated a passage in turn. The Inspector asked questions on the meaning of the words. The boys were also required to name the parts of speech from the passage, to use the same word as a noun and a verb, to make sentences, to define an adverb, and answer other questions.

Geography.—Such questions as the following were asked: Where is Northumberland? Where Hampshire? Norfolk? Staffordshire? By what line would you get to Bristol? to Portsmouth? to Brighton? to Yarmouth? Scarborough? Newcastle? Name the towns on the Trent. For what are they noted. What counties does the Trent flow through? Name the towns on the Thames. The counties North of the Thames. Counties South of it. Name some towns in Cornwall. What is St. Ives? Where is there another town of the same name?

STANDARD IV.

Arithmetic.—Specimen cards:—

A. 1. Divide £76,814 4s. by 192.

2. Multiply £69 18s. 3¾d. by 83.

3. Reduce 506,880 inches to miles.

4. I buy oranges at 2 for 1½d., and sell them at a penny each. What do I gain on 12 dozen?

B. 1. Multiply £8,090 12s. 7d. by 86.

2. Reduce 16 miles 3 furlongs 12 poles 4 yds. 10 inches to inches.

3. How many acres, &c., in 207,090 square feet?

4. A man buys a number of pigs at £1 10s. each. The total cost equals £39. How many does he buy?

Answers.—*A.* (1) £400 1s. 2d.; (2) £5,832 19s. 11¼d.; (3) 8 miles; (4) 3 shillings.

B. (1) £695,794 2s. 2d.; (2) 1,040,050 inches; (3) 4 acres 3 roods 20 yards; (4) 26 pigs.

Dictation.—The passage was selected from Longmans' Reader, pages 99—100:—

'The whole troop was now on our side of the river, but how were the animals forming the bridge to get themselves over? It was quite certain that number one must unwind his tail from the tree on the side of the stream. But the end of the bridge nearest to us was much lower than the other. If number one let go, then he and perhaps half-a-dozen of his companions would be soused into the water, or dashed upon the bank of the river.'

English.—The poetry was recited simultaneously and individually, and questions were asked on the meaning of words and sentences.

Sentences were given to be first analysed and then parsed.

Geography.—The teacher was required to question the class on Ireland.

STANDARD V.

Arithmetic.—Specimen cards:—

A. 1. Find the value of 390 articles at £70 12s. 4½d. each.

2. Make a bill for 19 lbs. at 2s. 6d. per lb., 3 st. 7 lb. at 1s. 4d. per lb., 7½ cwts. at 2s. 9d. a dozen lbs., 9 lbs. at 3s. 9d. per lb., 21 lbs. at 1s. 1½d. per lb.

3. $\frac{1}{8} + \frac{3}{8} + \frac{3}{7}$.

4. If a man weaves 6 pieces, each containing 7 handkerchiefs, in a week, how much might he earn in a year (52 weeks), if he is paid 7s. 9d. per dozen handkerchiefs?

B. 1. If 145 bushels last 19 horses for 74 days, how long would the same quantity last 37 horses?

2. Find the cost of 8 qrs. 5 bushels 3 pecks at 7s. 8d. per bushel.

3. $\frac{3}{8} + \frac{7}{10} - \frac{3}{8} + \frac{1}{2}$.

4. Make out the following bill:—

18 yds. at 3s. 9d. per yard.
8 pairs at 13s. 6d. per pair.
17 yds. at 1s. 4d. per yard.
81 yds. at 5s. 9d. a dozen yards.
12 shirts at 4s. 11d. each.

Answers.—*A.* (1) £27,541 6s. 3d.; (2) £2 7s. 6d. + £3 5s. 4d. + £9 12s. 6d. + £1 13s. 9d. + £1 3s. 7½d. = £18 2s. 8½d.; (3) $\frac{148}{168}$; (4) £70 14s. 10d.

B. (1) 38 days; (2) £26 14s. 9d.; (3) $1\frac{7}{10}$; (4) £3 7s. 6d. + £5 8s. + £1 2s. 8d. + £1 18s. 9¾d. + £2 19s. = £14 15s. 11¾d.

Composition.—The following story from 'Pleasant Stories for Composition' was told by the Inspector, to be reproduced by the boys:—

Curing the Measles.

'A lady had two children sick with the measles. She wrote to a trusty friend for advice. This friend at the time she got the letter was writing to a newly-married sister, telling her how to make pickles. As she finished the replies to the two inquiries she placed the letters on one side till she had addressed the envelopes. Then she placed a letter in each and posted them immediately. The next morning the anxious mother of the sick children opened her letter and read with horror, "Take them and scald them three times in hot vinegar, sprinkle them with salt, and in a few days they will be cured." When all was explained, it turned out that the letters had, by mistake, been put into the wrong envelopes. The lady who had asked about pickles got the safe cure for the measles, and *vice versâ*.'

English.—The poetry was repeated individually, and questions asked on the meaning of words and phrases. In Grammar five or six boys were examined at a time by the Inspector.

Geography.—Questions were asked by the teacher.

Standard VI.

Arithmetic.—Specimen cards:—

A. 1. Find the value of ·0125 of £1 + ·75 of 5s. 6d. — ·4 of 2s. 6d.

2. What is the rate per cent. per annum when the interest on £63 15s. amounts to £2 7s. 9¾d. in one year?

3. If a certain number be multiplied by $3\frac{1}{2}$, and the product divided by $70\frac{7}{8}$, and the result is $10\frac{3}{4}$, what is the number?

4. If 120 men finish a work in 35 days, how soon will 150 men finish it?

B. 1. Divide £1 between A, B and C, giving A ¼ more than C, and B three times as much as A.

2. £26 is ·325 of a sum of money. Find the sum.

3. Find the simple interest on £1,475 for 219 days at $4\frac{1}{2}$ per cent. per annum.

4. A house is let at 50 guineas a year; what amount of rent is due for 10 wks. 3 days?

Answers.—*A.* (1) 3s. 5d.; (2) $3\frac{3}{4}$ per cent.; (3) 216; (4) 28 days.

B. (1) A, 4s. 2d.; B, 12s. 6d.; C, 3s. 4d.; (2) £80; (3) £39 16s. 6d.; (4) £10 10s.

Composition.—Write a letter on a walk near London, or a visit to a museum.

Standard VII.

Arithmetic.—Specimen card:—

1. A railroad of 68 miles is completed by 265 men in 19 months. How many months should 159 men require to complete 51 miles?

2. A bookseller buys the following books:—

1 dozen at 3s. 6d. each.
6 copies at 4s. 2d. „
4 „ at 2s. 7d. „
3 „ at 1s. 4d. „

Find the average price of each book.

3. In a regiment of 960 men, $7\frac{1}{2}$ per cent. are sick, and $16\frac{2}{3}$ per cent. are on foreign service. How many are left for home duty?

4. One man mows a field in $8\frac{1}{2}$ days, and another does it in $12\frac{3}{4}$ days. How long would they be doing it working together?

Answers.—(1) $23\frac{3}{4}$ months; (2) 3s. $3\frac{1}{13}$d.; (3) 728; (4) $5\frac{1}{10}$ days.

Composition.—Write an essay on one of these subjects:—

A. Walks near London.

B. Museums.

C. Travelling in Asia.

English.—Five or six boys at a time were examined by the Inspector, and were required first to analyse and then to parse sentences from the poetry recited.

Geography.—In both 6th and 7th Standards the boys were questioned by the teachers of the class.

Our Certificate Class.

BY DR. GEORGE BEACH, M.A.

Head Master of Christ Church Schools, Macclesfield,

Co-author of 'Our Mother Tongue,' &c.

Our hearty acknowledgments are due to those courteous readers of our last series of articles who have kindly acceded to our request, and informed us of the result of their Christmas Examination.

To the successful we offer, as we have done in each case by letter, our cordial congratulations; upon those who have failed we would urge increased determination and labour, so that another disappointment may not ensue.

By kind permission we give extracts from a few of the letters forwarded :—

1. 'I have obtained a position in the *First Division* at the recent Examination, and since I was a close student of the columns devoted to your "Certificate Class," I thank you sincerely for the many hints and directions derived therefrom.'—S. P. (Dawley, Salop).

2. 'I am extremely pleased to inform you that I have succeeded in passing the recent Certificate Examination. *Your "Routines and Hints" have been the sole assistance that I have had.* Allow me to return my sincerest thanks for them.'—A. H. L. (Normanton).

3. 'I write to thank you for your valuable Routines, and am only sorry they did not come under my notice sooner. I have this week received notice of my failure. Had I been favoured with your valuable help throughout, I have no doubt the result would have been different.'

GENERAL HINTS.

1. READING, ETC.—A considerable number of candidates have already had their schools examined at too early a date for their Repetition to be ready. If they will apply to H.M. Inspector he will fix some school later on at which they may attend and go through the exercises.

2. GEOGRAPHY.—Particular attention should throughout the year be paid to Hindostan, as from a thorough knowledge of its geography no less than FORTY PER CENT. of the questions set to the Females can on the average be answered. Even with Males TWENTY-FIVE PER CENT. of the marks may be thus secured.

In the maps the lines of latitude and longitude should invariably be inserted. Female candidates should note that they will very probably have *no questions upon the British Isles.*

3. ALGEBRA.—The importance of facility in factorising cannot be too much insisted upon. The most advanced student can always find something to learn about factors.

From our correspondents we gather that we went forward with this subject a little too fast last year, an error that will not recur this year.

Many valuable 'wrinkles' may be picked up by studying the 'Model Answers' to Certificate Questions, and the Algebraic solutions in the 'Query Column.'

4. ARITHMETIC (Males).—All Male Candidates who have not passed with credit in Arithmetic in one of the two immediately preceding years, or have failed to obtain a Certificate, must answer the questions on Arithmetic and NOT those on Mensuration.

As the number of those taking Mensuration is very small, we have eliminated that subject from our Routines and devoted the time to Arithmetic.

It is almost impossible to give confident 'tips' to the MALES in this wide subject, but typical Government questions shall be given for the student's guidance.

With the FEMALES it is otherwise. One question at least is *every year* set upon Discount, Stocks, Compound Interest, Square Root, Insurance, Percentages, Vulgar or Decimal Fractions, and problems involving either G.C.M. or L.C.M.

Very *frequently, though not annually*, Ratios, Proportionate Shares, Partnerships, Clock sums, Race sums, 'Tap' sums, Averages, Mixtures, and peculiarities of the Calendar, receive attention.

The theory of nearly all the rules required, the proofs of the common arithmetical operations, and explanation of the short cuts of Mental Arithmetic are often requested.

Two other favourite points are the properties of the figure 9, and the curiosities of repeating decimals.

Ladies who are acquainted with Algebra will have an immense advantage.

5. ENGLISH.—*Shakespeare's Richard II.* was set for the Examinations of 1880 and 1884, and from the questions then given valuable hints can be gleaned.

The student should above all make himself master of the text of the play, then of the plot, the allusions, the grammatical constructions, its prosody, the principal characters, the source of the play, the historical events, the historical inaccuracies, the anachronisms, the proverbial expressions, the etymology of the vocabulary employed, the criticisms respecting it, the finest passages, and its position among Shakespeare's dramas.

By means of the Repetition, the Paraphrasing, the Parsing, &c, that we have mapped out, no consistent follower of our Routines can fail to pass in this subject.

Bacon's Essays have been previously appointed as follows :—

1879, Essays XXXII.—LVIII. ; 1880, Essays I.—XXVI. ; 1881, Essays XXVII. to end ; 1882, Essays I.—XXVI. ; 1883, Essays XXXVIII.—LVIII. ; 1884, Essays I.—XXX. ; 1886, Essays I.—XXV. ; 1887, Essays XXVI. to end ; 1889, Essays I.—XXVI. Thus a large amount of illuminating matter is placed at our disposal and for our enlightenment.

Lancelot and Elaine and Trench's Lectures have not previously been the selected books.

HISTORY.—*The Tudor Period* was chosen for the Examinations of 1873, 1874, 1883, 1884, 1886, and 1887.

The Stuart Period was the history to be studied in 1873, 1874, 1886, and 1889.

We recommend our students—I. To acquire a thorough knowledge of a rather scanty general historical outline ; II. To study the period under different heads, such as Literature, Constitutional Progress, Naval and Military matters, &c. ; III. To study each reign by itself ; IV. To learn a considerable number of dates thoroughly ; V. To be able to write the lives of the great men, the makers of history.

PENMANSHIP.—The Department require three qualities in handwriting : I. Legibility ; II. Regularity of outline ; III. Facility of execution. Its words are 'the writing should be running, free, and symmetrical, as well as legible and clear.'

Largehand 'should be three-eighths of an inch high, but providing it is bold and legible, and the proper forms and proportions of the letters are duly observed, my lords do not desire to prescribe a uniform rule either as to exact style or size.'

Smallhand 'as taught in schools is apt to be too small and indistinct. It should be firm, round, and legible.'

In both *hands* we would prefer to err rather towards the maximum than the minimum of size.

Copies set by Department :—

Largehand.

1. Baron von Hardenberg ... ... (1882)
2. Parenthetically ... ... (1883)
3. William the Conqueror ... ... (1884)
4. Imperial system ... ... (1885)
5. Royal prerogative ... ... (1886)
6. Chemical affinity ... ... (1887)
7. The Spanish Armada ... ... (1888)
8. Oxford University ... . (1889)

Smallhand.

1. The valley rings with mirth and joy . (1882)
2. The castled crag of Drachenfels ... (1883)
3. The warrior took that banner proud... (1884)
4. I see before me the Gladiator lie ... (1885)
5. Beware the pine tree's withered branch (1886)
6. Now the golden morn aloft
   Waves her dew bespangled wing ... (1887)
7. Now joy, old England, raise !
   For the tidings of thy might ... (1888)
8. Revenge is a kind of wild Justice ... (1889)

SCHOOL MANAGEMENT.

The chief points to be attended to are—

1. *Registration and Returns.*—What registers are required—the particulars they contain—how to keep and verify them—the laws respecting admission, leaving, school fees, half-timers, etc.—how to fill up 'Form IX.'—how to keep the log book.

2. *Organisation and Management.*—Principles of organisation and classification—drawing-up of routines—how to distribute the teaching staff—how to train pupil teachers—how to suit the curriculum to the locality—Notes of Lessons—Courses of Lessons.

3. *Processes of Reasoning, Habits and Character, &c.*—The laws and provinces of memory, attention, association of ideas, invention, imagination, the various methods of reasoning—the most common fallacies—the various logical terms—area of teacher's influence—how to inculcate good habits—how to eradicate various vices—the theory of rewards and punishments.

4. *Premises.*—Different systems of draining surfaces and disposing of nuisances—space, etc., per scholar—best methods of ventilation and heating—best methods of lighting—best forms of windows and panes—best colours for panes, walls, blinds, etc.

5. *Persons.*—Cleanliness—effect of punishments—home lessons—forms of recreation, and position and posture of teachers and scholars.

It should always be remembered that the best foundations for a sound knowledge of this subject are (1) a thorough acquaintance with the tripartite constitution of the human animal, and (2) practical experience in a good school. Much of the matter written about School Management is words—mere words.

EUCLID.—Nobody unable to solve simple Deductions knows 'Euclid.' Too frequently the exercises are completely neglected, and the Propositions alone relied upon, and a fearful waste of marks thus ensues.

The Propositions are similar to proofs of Arithmetical and Algebraic Rules, and the Deductions to Arithmetical and Algebraic exercises. If a person could prove the 'Rule of Three,' but could not work a Proportion sum, we should not allow to him a knowledge of that rule.

In Book I. the examiners do not appear to have any favourite Propositions, but in the other books their preference is clearly shown.

The following Propositions have been oftenest set:—*Book II.*, Props. 3, 4, 12, 14. *Book III.*, 3, 15, 17, 18, 22, 32, 35, 36. *Book IV.*, 4, 5, 6, 10. *Book VI.*, 2, 8, 13.

The Definitions of Book V. should be well understood with their Algebraic equivalents, as should also the Algebraic proofs of Second Book Propositions.

DOMESTIC ECONOMY.

This is a very easy subject (we speak not only from theory but practice), there being always a considerable choice of questions, and many of them being such as a good housewife ordinarily educated could answer.

There is a very close connection between one branch of this subject and 'the laws of health as applied to premises, scholars and teachers,' which comes under the head of School Management. Indeed, until 1886, this point was included in Domestic Economy. The particular features oftenest enquired into are:

Food, Beverages, Cooking, &c.—The constituents of foods—the value of various diets—different methods of cooking—economical courses of dinners—familiar recipes—kitchen utensils—fire places—the assimilation of nourishment—the management of the sick.

Household Management.—The disposal of weekly wages—vaccination—symptoms and treatment of and precautions against infantile complaints—accidents—antidotes against poisons.

Investments.—Co-operative stores—building and benefit societies—penny banks—Post-office facilities for saving and investing—and thrift in general.

THE ROUTINES.

PARAPHRASING.

A (Richard II., Lines 30—46, Scene I., Act I.)

I call God as the witness of what I say. Out of my great solicitude for the king's security, and with no basely-sprung hatred, I appear before his majesty, to whom I am ardently attached by loyal affection, as the accuser of Thomas Mowbray. I will now address myself to him and my words should be carefully noted, for all that I assert I will prove by victorious single combat, or even if slain, my immortal spirit shall be responsible for it on high, etc.

B (Richard II., Lines 132—151, Scene 1, Act I.)

As for Gloucester's execution, I did not kill him; yea, I was even guilty of a shameful procrastination. As regards the Duke of Lancaster, my enemy's respected sire, I confess that I did once plot to kill him. This misdeed, however, has troubled me sore, and before I last partook of the 'holy elements,' I made known my fault to the duke, and earnestly besought his forgiveness, which I trust I obtained, etc.

C (Richard II., Lines 11—34, Scene 1, Act II.)

Does not fraternal love urge you on more strongly than this? Has your affection quite died away in your old age? Your father had six sons besides yourself. All seven of you had the same revered blood in your veins, all sprang from the same origin. Several of your brothers have in accordance with their fates died a natural death. But your brother, Thomas, my loved husband, one of the great Edward's sons, one of this great king's children, has shed his blood through violence, and this vigorous limb of Edward's body has been cruelly amputated, and the promise of his life been destroyed. He has perished on the scaffold through murderous malice, etc.

D (Bacon's Essays, No. L.)

Some books need only a superficial perusal, others should be carefully read, whilst a small number should be pondered over and their contents absorbed.

The first of these classes may be only 'dipped-into,' the second read through but not studiously, but the third calls for thought and application.

Some works need not be read at first hand, but as it were by proxy, through their pithy passages selected by others. This applies, however, only to a low class and to inferior subjects, etc.

E (Lancelot and Elaine, Lines 158—179.)

Sir Lancelot at once set out on horseback, angered at himself. As he did not wish to be recognised, he turned aside from the hard-trodden highway, selecting bye-paths whose turf proved them to be unfrequented. Riding among the lonely hills, wrapt in thought, he strayed from the road; but followed another way almost indiscernible that meandered along the vales to Astolat.

PARSING.

A (Richard II., Lines 86—97, Scene 1, Act I.)

Look, what, true, that, received, highness', which, like, traitor, besides, or, that, complotted, head.

B (Richard II., Lines 59—68, Scene 3, Act I.)

O, let, profane, if, gored, as, fight, lord, Lord Aumerle, sick, as, so, last, sweet.

HISTORY.

Males.

(Davies, pp. 170 to 173.)

Omit all not relating to Thomas Sackville, Raleigh, Spenser, Marlow, Drayton, Shakespeare and Johnson.

Females.

(Davies, pp. 79—92.)

Of pages 82—92 omit all not relating to Shakespeare, Jonson, Milton, Butler, Dryden, Raleigh, Evelyn, Pepys, Burnet, Jeremy Taylor, Baxter, Bunyan, Barrow, Bacon, Newton.

ARITHMETIC.

Females.

(Time one hour.)

Selected Government Questions.

1. Give outlines of notes of a *first* lesson on least common multiple.

On a rock are three revolving lights; one revolves in 65 seconds, another in 78, and the third in 90. If I see them all bright at 10 p.m., when will they next be so? (1882.)

2. Divide £2 12s. among 5 men 7 women and 14 boys so that each woman may have ¾ of each man's share, and each boy ½ of each woman's share. (1882.)

3. How soon after 12 o'clock at noon will the hour and minutes hands of a clock be together; and at what point of time between 7 and 8 will they again come together? (1883.)

4. How much does a creditor to the amount of £9,518 receive when his debtor pays ·625£ in the £. Prove by Vulgar Fractions. (1883.)

ALGEBRA.

Males.

(Time two hours.)

1. Prove that the cube of the sum of any two quantities exceeds the sum of their cubes by three times their product multiplied by their sum. (1882.)

2. Multiply $x^3 + (a - b)\,x - ab$ by $x^2 - (a - b)\,x - ab$ and divide the result by $x^2 + (a + b)\,x + ab$. (1882.)

3. Prove that in finding the G.C.M. of any two quantities any factor not common to both quantities may be introduced or removed without affecting the result. Find G.C.M. of $x^4 - 21x + 8$ and $8x^4 - 21x^3 + 1$. (1882.)

4. Simplify—

$$\left\{\frac{x+y}{x-y} - \frac{x^2+y^2+xy}{x^2+y^2-xy}\right\} \times \left\{\frac{x-y}{x+y} - \frac{x^2+y^2-xy}{x^2+y^2+xy}\right\}$$

(1882.)

5. Find the value of $\frac{x}{2} - \left\{\frac{2x-3}{3} - \frac{3x-1}{4}\right\} - \frac{3x+1}{4}$ where $x = 3$. Prove that if the difference of two quantities $= p$ then p times their sum $= q$ times the difference of their squares. (1883.)

6. Show that $(a - b)(x - a)(x - b) + (b - c)(x - b)(x - c) + (c - a)(x - c)(x - a) = (a - b)ab + (b - c)bc + (c - a)ca$. (1883.)

7. Find G.C.M. of $x^3 + 11x + 12$ and $x^3 + 11x^2 - 54$. (1883.)

8. Simplify—

$$\frac{1}{x-1} - \frac{1}{2(x+1)} - \frac{x+3}{2(x^2+1)} - \frac{x+3}{x^4-1}.$$ (1883).

MISCELLANEOUS QUESTIONS FOR SECOND AND FOURTH SATURDAYS.

Males.

(Time four hours.)

1. Explain clearly and simply, as to a pupil teacher, the system of teaching writing which you prefer. (1882.)

2. Draw up full notes for a lesson to an advanced class on—

'Owing to the more equal temperature of the sea, islands are not subject to the same extremes of heat and cold as inland or continental countries.' (1882.)

3. Supposing that 20 hours per week were available for teaching Reading, Writing, Arithmetic, Geography, Grammar, Drawing and Singing; state how many hours you would devote to each subject, and assign your reasons for the proportions adopted. (1882.)

4. Write a brief essay on 'Newspapers.' (1882.)

5. State fully what appears to you to be Shakespeare's chief claim to pre-eminence among poets. (1882.)

6. Explain the meaning of the term 'Subjunctive Mood,' and give examples of the various relational ideas which it expresses. (1883.)

7. Draw a physical map of Hindostan *or* New Zealand. (1882.)

8. Enumerate the different lines which are usually traced upon a map of the world; and explain more fully how the lines of latitude and longitude are determined. Why are degrees of longitude not equal in length? (1882.)

9. In which of the five zones are Ceylon, New Zealand, Cape Colony, and Hindostan situated? Mention some of the flora peculiar to the torrid zone. (1883.)

10. How did the English crown pass to the Stuarts? (1872.)

11. Write out the chief dates of the Norman Period *or* of James the First's reign. (1874.)

12. The divisions and quarrels that led to the battle of Bosworth; a full account of that engagement and its results. (1870.)

13. A man sells out £1,150 Stock from the Russian Four per Cents. at 92, and buys with the proceeds American Stock, paying 3½ per cent. What price did he pay for the latter Stock if he gain £10 per year by the change? (1882.)

14. Find to two places of decimals the diagonal of a face of a cube which contains 95443·993 cubic inches. (1883.)

15. To draw a straight line perpendicular to a given straight line *of an unlimited length* from a given point without it. Explain why the italicised words are necessary. (1882.)

16. Prove Prop. 2, Book III. Euclid. (1882.)

Females.

Questions 1—11 inclusive, as for Males.

12. The chief steps in colonisation taken during reign of James I. (1870.)

13. 'Milk is an example of a substance containing all the requisites for supporting a healthy and vigorous existence.' Name these requisites and their adaptation to the needs of the human system. (1871.)

14. State as accurately as you can the income and household expenses of a peasant's family, consisting of husband, wife and three children (ages of children, 6, 4, 2½ years). (1871.)

15. Name any secure investments for small sums of money, the interest so obtained, and the method by which such money can be withdrawn. (1871.)

16. 'Nothing is easier than so to mend a hole in a stocking, so that two or more holes are formed in its stead.' Show the truth of this assertion, and explain clearly the remedy. (1878.)

FAILING SUBJECTS.

Nothing authoritative respecting these has been promulgated since 1882, but it is an open secret that the then rules are still operative.

'Acting teachers may obtain Certificates who can read and write well, and answer simple questions confined to the following subjects:—History, Geography, Arithmetic, Composition, Spelling, Parsing, School Management, and, in the case of Females, Needlework.

'Geometry is requisite for those Male teachers about to be entrusted with the charge of pupil teachers.

'Failure in Needlework, Arithmetic, English, or School Management excludes a Candidate from a Certificate.'

ROUTINE FOR APRIL (MALES).

DAY	FIRST WEEK			SECOND WEEK			THIRD WEEK			FOURTH WEEK		
MONDAY	Algebra. — Factorising	History. — Dates from 1066 to 1189 The Norman Dynasty	School Management. — Articles 81 to 86 of Code Articles 1 to 7 of Circular No. 217 First half of p. 128 (Heller's Code)	Algebra. — H. C. F. and L. C. M.	History. — Outlines from 1066 to 1100	School Management. — Notes of a Reading Lesson to Standard I.	Algebra. — Simple Equations	History. — Outlines from 1100 to 1199	School Management. — Write out a list of Good Habits with their opposing Bad Habits	Algebra. — Government Questions (See Article)	History. — Outlines from 1199 to 1307	School Management. — Infectious Diseases, Wounds, and Cutaneous Disorders, pp. 163 to 202 Carpenter
TUESDAY	Euclid. — Prop. I. to XIII., Book I.	Map — England.	English. — Paraphrase Lines 30 to 46, Scene I., Act I., Richard II.	Euclid. — Deductions 40, 45, 52, 58, 60, 64, 63, 74, 82, 83 of Egan, Part I.	Map. — Australia	English. — Paraphrase 'Some books are to be tasted, others to be swallowed . . . . know that he doth not.'—Bacon's Essays, No. I.	Euclid. — All Book I.	Map. — Hindostan (Physical)	English. — Paraphrase Lines 158—179 Lancelot and Elaine	Euclid. — Deductions 352, 359, 363, 364, 366, 369, 371, 374, 378, 388 of Egan, Part I.	Geography. — Motions of the Earth	English. — Paraphrase Lines 132—151 Scene I., Act I., Richard II.
WEDNESDAY	Arithmetic. — Square Root	English. — Write 20 lines of Composition on Lines 41 and 42 of Scene I., Act I., Richard II.	Euclid. — Deductions 13, 14, 16, 19, 20, 23, 25, 26, 31, 36 of Egan, Part I.	Arithmetic. — Cube Root	English. — Write 20 Lines of Composition on 'The Mariners of England.'	Euclid. — First 41 Propositions of Book I.	Arithmetic. — Square Root and Cube Root	Algebra. — Revise the various formulæ.	Euclid. — Deductions 135, 137, 148, 151, 156, 163, 165, 168, 175, 179 of Egan, Part I.	Arithmetic. — Stocks	English. — Richard II. to end of Scene I., Act II.	Euclid. — All Book II.
THURSDAY	School Management. — Processes of Reasoning, pp. 54—67, Dr. Coupland	Geography. — British Possessions in Europe	English. — Richard II. to end of Scene II., Act I.	School Management. — Spencer on Education (See Article thereon	Geography. — Hindostan	English. — First 44 Lines of Lancelot and Elaine	School Management. — Articles 1 to 22 of Circular 217; and p. 128 of Heller's Code	Geography. — Hindostan	English. — Write 20 lines of Composition on 'The Causes of Tudor Despotism'	School Management. — Spencer on Education (See Article thereon)	Geography. — Causes which affect Climate	English. — Lines 144 to 316 of Lancelot and Elaine
FRIDAY	Algebra. — Involution and Evolution	History. — Reign of Henry VII., pp. 3—21 of Davies	Writing. — 1 Dictation 2 Copy Book Writing 3 Word or passage previously set	Algebra. — Fractions	History. — Literature, pp. 170 to 173 Davies. (See Article)	Arithmetic. — Stocks	Algebra. — Simultaneous Equations	History. — Reign of Henry VIII., pp. 21—38 Davies	Geography. — Hindostan	English. — Richard II. to end of Scene III., Act I.	History. — Reign of Henry VIII., pp. 38—58 Davies	English. — Bacon's Essays, 14—16
SATURDAY	Euclid. — First 26 Propositions of Book I.	English. — Bacon's Essays, 1, 2, 4	School Management. — Site of School, pp. 1—27, Carpenter's Hygiene	Geography. — Shape and Size of the Earth	Euclid. — Deductions 92, 101, 105, 107, 110, 113, 115, 118, 121, 128 of Egan, Part I.	Examination — Miscellaneous (See Article)	School Management. — Learn what Registers are necessary. The Admission Register	Euclid. — First 10 Propositions of Book II.	English. — Bacon's Essays, 5, 9 and 11	Algebra. — Government Questions. (See Article)	Geography. — Causes which affect Climate	History. — Lives of Great Men, pp. 180—185, Davies	Examination — Miscellaneous (See Article)	English. — Lines 316 to 505 of Lancelot and Elaine

ROUTINE FOR APRIL (FEMALES).

DAY	FIRST WEEK			SECOND WEEK			THIRD WEEK			FOURTH WEEK		
MONDAY	Arithmetic. — Vulgar Fractions	History. — Dates of James I. Curtis' Date Book	School Management. — Articles 82 to 86 of Code Articles 1 to 7 of Circular No. 217 First half of page 128 Heller's Code	Arithmetic. — Interest	History. — Reign of James I.	School Management. — Notes of a Reading Lesson to Standard I.	Arithmetic — Stocks	History. — Reign of Charles I. from 1640 to 1649	School Management. — Write out a List of Good Habits with their opposing Bad Habits	Arithmetic. — Discount	History. — Reign of Charles II.	School Management. — Infectious Disorders Cutaneous Diseases Wounds pp. 163 to 202 Carpenter
TUESDAY	Domestic Economy. — The essential constituents of a True Food	Geography — Map of Hindostan (Physical)	English. — Paraphrase Lines 30—46, Act I. Scene I. Richard II.	Domestic Economy. — The different diets required for Ordinary Ailments	Geography. — Map of Hindostan (Political)	English. — Paraphrase Lines 11—34 Act II. Scene I. Richard II.	Domestic Economy. — Describe a house and its furniture which can be maintained in a small town for 30/- per week	Geography. — Map of Further India	English. — Analyse and Parse difficult words of lines 86—97 Scene I., Act I. Richard II.	Domestic Economy. — Give instances (with reasons) shewing at what times it is advantageous to purchase particular articles	Geography — British Possessions in Europe	English. — Paraphrase Lines 132—152, Scene I. Act I. Richard II.
WEDNESDAY	Arithmetic. — Decimal Fractions	English. — Write 20 Lines of Composition on Lines 41 and 42, Scene I., Act I. Richard II.	Sewing, etc. — Learn the measurements of 'a woman's night-dress'	Arithmetic. — Insurance	English. — Write 20 Lines of Composition on 'The Mariners of England'	Sewing, etc. — Cut out (on sectional paper) and tack together the right half of a woman's night-dress	Arithmetic — Stocks	Sewing, etc. — Practise the different stitches on a piece of linen 9 ins. square	Domestic Economy. — How would you make Gruel, Beef-Tea and Barley Water?	Arithmetic — Square Root and Fourth Root	Sewing, etc. — Learn the measurements and draw the diagram of 'a child's muslin pinafore'	Domestic Economy. — How can a working man best invest a few pounds annually?
THURSDAY	School Management. — Processes of Reasoning pp. 54—67 Dr. Coupland	Geography. — Physical Geography of Hindostan	English. — Notes and Text of Richard II. to end of Scene II., Act I.	School Management. — Spencer on Education (see Article thereon)	Geography. — Hindostan (Political)	English. — Analyse and Parse difficult words of lines 59—68 Scene III., Act I. Richard II.	School Management. — Articles 1 to 22 of Circular 217, and p. 128 Heller's Code	Geography. — Cyprus, Ceylon, Aden	English. — Notes and text of Richard II. to end of Scene IV., Act I.	School Management. — Spencer on Education (see Article thereon)	Geogra — Burmah and Further India	English. — Notes and text of Richard II. to end of Scene II., Act II.
FRIDAY	Arithmetic — Proportion	History. — Davies pp. 79 to 84 (see Article)	Writing. 1. Dictation. 2. Copy Book Writing. 3. Word or passage previously set.	Arithmetic. — Government Questions. (see Article)	History. — Reign of Charles I to 1640	Sewing, etc — Practise 'stocking web' and a 'print patch'	Arithmetic — Discount	History. — The Commonwealth	Any backward work	English. — Write short lives of— 1. Raleigh 2. Bunyan and 3. Bacon	History. — Dates 1624 to 1641 Curtis' Date Book	Sewing, etc. — Practise the different stitches on a piece of calico 9 ins. square
SATURDAY	Domestic Economy. — Advantages of a 'Mixed Diet' (flesh and vegetable) and Disorders from Improper diets	English. — Trench Half of Lecture I.	School Management. — Site of School pp. 1—27 Carpenter's Hygiene	Geography — Hindostan (Physical)	Sewing, etc.	Examination — Miscellaneous (see Article)	School Management. — Learn what Registers are necessary. The Admission Register	Domestic Economy. — How should an Artisan's wage of 35/- be spent in a family of six?	English. — Trench Lecture I.	Geography — Hindostan (Political)	Sewing, etc. — Cut out (on sectional paper) and tack together the sleeve half of a muslin pinafore	History. — Davies pp. 85 to 92 (see Article)	Examination — Miscellaneous (see Article)	English. — Trench Half of Lecture II.

CORRESPONDENCE.

We shall be pleased to reply briefly and through this column to any seeking information or advice. Endorse 'CERTIFICATE EDITOR' *if directed to office.*

Replies demanding urgency will be promptly forwarded per post on receipt of stamped and addressed envelope. This privilege does not extend to furnishing the solutions and answers of examination questions. A post will be saved by addressing direct to Macclesfield.

Any suggestion tending to the greater utility and interest of these articles, or to the greater convenience of 'COACH' *or* PUPIL, *will be thankfully received and thoughtfully considered.*

A J. (Exeter).—It is not necessary that you should actually be on the Staff of a School, in order to sit at the Christmas Examination. The present oversupply of teachers would cause this restriction to be an intolerable injustice.

ALFRED (Northailerton).—(1) The article obliging all newly-appointed assistants to pass the Scholarship Examination will *probably* be re-introduced into the Code. (2) Take second year papers, if Code allow.

E. J. A. (South Norwood).—A teacher who obtained a Certificate on First Year Papers at Christmas, 1889, may attempt the Second Year Papers in 1890.

ANNIE W. (Carmarthen).—We cannot decide. Write to Department.

'ALICE G.' (Winterton).—(1) Shakespeare's 'King John,' Tennyson's 'Coming of Arthur,' and 'Passing of Arthur,' and Bacon's Essays, as this year. (2) Not stated by Department.

E. C. (Queensbury).—(1) See answer to E. J. A. (2) It would entirely depend upon your attainments and opportunities. (3) We know of no good edition.

'ZDY' (Stourbridge).—(1) There will be many hints bearing upon your examinations. (2) It is not a Degree.

J. W. (Leith).—Within our limits we could not treat of the Scholarship Exam. Confusion would ensue.

'X. Y. Z.' (Soho).—Hewitt and Beach's 'Mother Tongue' would certainly suffice for College of Preceptors.

H. B. (Todmorden).—See body of article 'General Hints.'

J. L. (Lincoln).—Not necessarily, but probably the 'Part' suited to your voice.

'T. SIMON' (Huddersfield).—The Inspector will arrange with you.

A. M. (Amesbury), E. J. G. (Upper Bangor), L. N. (Cockermouth), 'CYMRI' (Cardiff), J. H. H. (Littleboro'), A. H. L. (Normanton), T. C. (Kippax), '?' (Gainsborough), S. P. (Dawley), D. M. (East Brora, Sutherland), H. B. (Clifton Wood), H. J. (Connah's Quay), C. C. R. (Langley, Oldbury), E. W. (Leeds), C. H. (Harlesden), answered per ordinary letter.

We desire also to thank those readers of our 1889 articles who have kindly informed us of their examination results.

(To be continued.)

Occasional Examination Papers.

MOST teachers find it desirable from time to time to apply some general tests to ascertain what relative progress their pupils are making. This can be done with the greatest freedom, and probably with the best effect in middle and higher class schools. In elementary schools examinations for testing purposes are very frequent, but they are perhaps too often regulated entirely by the Code requirements and confined for each child to the special work of his particular standard. With freedom of classification, however, it is likely that examinations would be used for deciding questions of promotion from class to class, and would accordingly take a rather wider range than is usual under present circumstances.

At the same time we believe that whatever the condition of educational work may be, it would be decidedly advantageous to employ general examinations as a means of stimulating intellectual effort in the pupils and encouraging an all-round type of development.

As samples of examination papers of the sort we consider suitable for the purpose we have indicated, we offer two papers recently set at an institution in which many of our readers may feel interested,—The Teachers' Orphan Home for Boys, at Peckham. The boys for whom the papers were intended were from 9 to 15 years of age. We hope the questions may, by way of example and suggestion, prove useful to teachers in schools of various classes. Answers are supplied to the questions in arithmetic.

FIRST PAPER.—GENERAL KNOWLEDGE.

1. Name the Queen of England, her eldest son, her eldest daughter, her two best-known grandsons, her father, and her husband. State the most important facts you know about each of them.

2. Give one or two names of the most eminent living persons under each of the following heads:—Statesmen, Soldiers, Poets, Prose-writers, Travellers, Engineers, Men of Science. Add a brief statement to show why each of them is famous.

3. Who wrote each of the following works:—The Canterbury Tales, The Faerie Queen, King Lear, Paradise Lost, The Pilgrim's Progress, Robinson Crusoe, Gulliver's Travels, Ivanhoe, Westward Ho, Idylls of the King. Give a short account of one of these books.

4. Explain briefly the nature and use of the following:—A Filter, a Funnel, a Syphon, a Telescope, a Barometer, a Thermometer, a Gas-meter, a Telephone, a Mariner's Compass, a Blow-pipe, a Pair of Compasses, a Set-square.

5. What are the following? A Trades' Union, a Strike, a Lock-out, a Revolution, a Republic, a Siege, a Guild, a Polytechnic? Give an example of each.

6. Name the most important manufactures carried on in London, and describe one of them.

7. If you carefully examined an English wood, what animals would you be likely to meet with—Quadrupeds, Birds, Reptiles, Insects, and others? Also, what fish are found in English rivers?

8. Write a short anecdote about some animal.

SECOND PAPER.—ARITHMETIC.

1. Add together 9,087; 16; 3,009; 478; 888; and 45.
2. Take 5,009 from 9,500.
3. Multiply 786,592 by 375.
4. Divide 800, 670 by 59.
5. A tradesman received £19 6s. 8d. on Monday, £75 3s. 7½d. on Tuesday, £32 16s. 4½d. on Wednesday, £25 17s. 6½d. on Thursday, £29 18s. 4d. on Friday, and £68 14s. 7d. on Saturday. How much did he receive in the week?

6. If I have six £5 notes in my purse how much shall I have after paying a bill of £19 19s. 0½d.?

7. A man built a row of sixteen houses. They cost on an average £576 11s. 7½d. each. How much did the row cost?

8. If a ship is worth £37,866 what is the worth of a twenty-seventh share of it?

9. Reduce 95 miles 14 yards to inches.

10. If a ton of metal is worth £392, what is a pound worth?

11. A field can be mowed by 35 men in 16 hours, how many men could mow it in twenty hours?

12. Make a bill for the following articles:—17 lbs. of bacon at 6½d. per lb., 70 eggs at 9d. per doz., 12¼ lbs. of butter at 1s. 1d. per lb., 14 lbs. of cheese at 7½d. per lb., 19½ lbs. of lard at 5½d. per lb.

13. How much is $\frac{2}{7}$ of £1 + $\frac{1}{7}$ of a florin — $\frac{3}{8}$ of half a crown?

14. If 2·8 lbs. of tea cost 3·85 florins, what will a chest of 33 lbs. cost?

15. Find the amount of £575 lent for 4½ years at 3 per cent. simple interest.

16. What discount should be allowed on a bill of £572 4s. 4d. paid six months before it is due, interest being reckoned at 4 per cent. per annum?

17. If $38\cdot\dot{5}$ of £118 were written for 38·5 of £108, what would be the amount of the error?

18. Simplify—

$$\frac{(3\cdot71 - 1\cdot908) \times 7\cdot03}{2\cdot\dot{2} - \frac{7\cdot4}{3\cdot\dot{3}}}.$$

ANSWERS.

1. 13,523.
2. 3,996.
3. 294,972,000.
4. 13,570 + 40 over.
5. £251 17s. 1½d.
6. £10 0s. 11½d.
7. £9,225 6s.
8. £1,402 8s. 10½d.
9. 6,019,704 inches.
10. 3s. 6d.
11. 28 men.
12. 9s. 2½d. + 4s. 4½d. + 13s. 3½d. + 8s. 9d. + 8s. 11¼d. = £2 4s. 6½d.
13. 5s. 0¾d.
14. £4 5s. 9d.
15. £652 12s. 6d.
16. £11 4s. 4$\frac{4}{11}$d.
17. £391 11s. 1¼d.
18. 6·33403.

Certificates of the College of Preceptors.

THE Examinations of the College of Preceptors are already well known and highly appreciated. Their higher certificates entitle the holders to exemption from the preliminary literary examinations of the Law Society, Medical Corporations, the Pharmaceutical Society, and the Royal Veterinary College.

The examinations are held half-yearly, the fee for each candidate being ten shillings. The Midsummer Examination will be held on the 17th of June, 1890, and the Christmas Examination on the 19th of December, 1890.

Three classes of general certificates are awarded, and each class is arranged in divisions. There is no age limit for the three classes.

Papers in foreign languages are divided into three parts:

(1) Translation into English.
(2) Grammatical questions.
(3) Translation into the foreign language.

In order to pass, the candidate must satisfy the Examiner in two parts of the paper.

Any candidate who fails to obtain the certificate for which he has been entered, may receive the certificate of a lower class, provided he fulfils the conditions required for it.

First Class.

In order to obtain the First Class, candidates must pass in eight subjects, and may be examined in as many as five additional ones.

Compulsory subjects are:—

(*a*) English Grammar and Analysis, and *either* Outlines of the History of the Language *or* questions on a set book.

(*b*) English History.

(*c*) Geography (including Physical and Mathematical), Arithmetic.

One, or both, of the following Mathematical subjects:—

(*a*) Algebra (including Quadratic Equations, with simple questions on Surds, Indices, Progressions, Ratio, Proportion, and Variation.

(*b*) Euclid, Books I—IV.

One or two of the following foreign languages:—

(*a*) Latin. (*b*) French. (*c*) German. (*d*) Italian. (*e*) Spanish. (*f*) Greek.

The optional subjects are very numerous, and include some of those previously mentioned, when not taken as compulsory subjects, and, among others, Mechanics, Mensuration, Book-keeping, Physics, Chemistry, Natural History, Political Economy, Music, and Drawing.

Second Class.

Candidates must pass in six obligatory subjects, and may be examined in four, or any less number, of optional subjects; but no candidate will be examined in more than ten subjects.

COMPULSORY SUBJECTS:

English Grammar, with analysis of simple sentences and easy complex sentences, and questions on a set book.

Outlines of English History, from the Conquest to the end of the Tudor Period.

Geography.

Arithmetic.

Algebra (including Simple Equations and Fractions), or Euclid (Book I.).

One of the following foreign languages:

(*a*) Latin. (*b*) Greek. (*c*) French. (*d*) German. (*e*) Spanish. (*f*) Italian.

OPTIONAL SUBJECTS:

The four optional subjects may be selected from the non-obligatory foreign languages specified above, or from the former list of optional subjects.

Third Class.

Candidates must pass in four compulsory subjects, and may be examined in four or any less number of optional subjects, but no candidate will be examined in more than eight subjects.

Compulsory Subjects:

English Grammar.

Outlines of English History, from the Conquest to the end of the Tudor Period.

Geography of Europe, especially of British Isles, including the meaning and use of simple geographical terms.

Arithmetic (the first four rules, Simple and Compound Reduction, Vulgar Fractions, Simple Proportion, and simple questions in practice).

Optional Subjects:

The optional subjects for the Third Class are: Latin, any modern foreign language, Euclid, Algebra, and Scripture (for all of which Third Class papers are set), or any of the optional subjects previously mentioned.

Fuller information, and a Syllabus containing a time-table and dates of the Examinations, can be had from the Secretary of the College of Preceptors, Bloomsbury-square, London W.C.

Publications Received.

Bacon, G. W., & Co.—Picture: 'Christ Blessing little Children;' The Excelsior Map of the British Isles.

Blackie & Son.—Blackie's Cyclopædia, vol. V. (*Dr. Allandale*); Elementary Text Books:—Chemistry, Part I. (*W. Jerome Harrison*); Vere Foster's Drawing Copy Books.

Clay, C. J., & Sons.—The Smaller Cambridge Bible for Schools—St. Luke (*Farrar*); St. Mark (*Maclear*).

Curwen & Sons.—School Cantata: The Man in the Moon (*Brown & Deffell*); Saltaire Action Songs (*Lois Bates*); Action Songs:—The Chinese Umbrella (*C. Hutchins Lewis*); The British Flag (*Percy Jackman*).

Dawson, A. G.—Mental Arithmetic, Standard V. (*Macnamara*); Standard Teaching Helps, Standard IV. (*Major*); Periodical Examination Report Form.

Fisher Unwin, T.—Revue Bleue; Revue Scientifique.

Gill, G., & Sons.—South Kensington Mathematics (*Ben Jonson*); Guide to the Scholarship Examination (*Benson Clough*).

Longmans & Co.—The Teacher's Handbook of Psychology (*Sully*); School Hygiene (*Abel*).

Macmillan & Co.—Two Years Ago (*Charles Kingsley*), Cheap Edition; English Men of Action: Captain Cook (*Walter Besant*); Macmillan's Latin Course, Part II. (*Cook*).

Murby, T.—The Educationalist, Nos. 2 & 3.

Nutt, David.—Alphabetical French-English List of Technical Military Terms (*M. Deshumbert*).

Philip, G., & Son.—The Young Folks' Song Book (*H. Berkeley Score*).

Sampson, Low & Co.—Jackson's New Style Vertical Writing Copy Books, Nos. 9 to 12.

Smith Elder & Co.—Vanity Fair (*Thackeray*), Popular Edition; The Cornhill Magazine, March.

Stanford, E.—Mnemonic Time Charts of English History (*David Ross*).

Ward, Lock & Co.—Lippincott's Monthly Magazine, March.

PRIZE COMPETITION.

We have the pleasure to announce that a prize of

ONE GUINEA

will be given for the copyright of the best ORIGINAL WORDS *for an action song. The Editor reserves to himself the right of buying the words sent in by any unsuccessful competitor for half-a-guinea. As in no case can MSS. be returned, competitors are particularly requested to retain copies.*

All communications should reach our office not later than April 12*th, and be addressed*

The Editor of
The Practical Teacher,
Pilgrim Street,
Ludgate Hill,
London, E.C.

Prize Competition.

The successful words, set to music, will be published in our May issue.

☛ Another Money Prize Competition will be announced in our next number.

Short Studies in English Literature.

BY C. J. DAWSON, B.A.,

Ex-President of the N.U.T.

II.

Milton's L'Allegro and Il Penseroso

(continued).

In studying the literary form of a poem the most important consideration is, as stated in the preceding paper, the fitness of the form as a medium for expressing the poet's thoughts. Upon the degree in which the form is adapted to the subject and spirit of the poem depends in great measure the quality of the work as literature. A general idea on this question of adaptation can be obtained in the same way, and indeed almost at the same time, by a thoughtful reading of the poem or by carefully listening while it is read aloud. That the poem should be read aloud is, for the purpose at present in view, of some importance; for much depends on the sound, and it is not everyone who is able to hear with his eyes.

When the student has thus formed his general impression from careful reading, he will do well, as in the case of the essence of the poem, to endeavour to refer the various features of this general impression to the different characteristics of the literary form. In other words he should proceed to analyse the form into its principal elements. The two main heads of this analysis in the case of a poem may be regarded as rhythm and diction. Under the former may be included metre, accent, rhyme and alliteration; under the latter the choice and placing of words, the various kinds of figures employed, and points of grammatical construction. In the making of such analysis as we have suggested we will endeavour to act as guide, with the preliminary caution, however, that unless the student does the actual work of observing, comparing, and classifying for himself, the real advantage of his literary study will be but slight.

Let us assume then that our readers have formed their general opinion of the literary form of Milton's two companion poems, *L'Allegro and Il Penseroso;* and let us assume further that it agrees with that which sympathetic minds have usually formed. No one with an ear for the music of poetry, and a taste for expressive word-pictures, can fail to appreciate the ease and sweetness of the rhythm, and the fitness and beauty of the language, in which Milton has presented these pastoral idylls. What some of the greatest of critics have said of Milton's work in these poems may be worthy of attention as constituting fitting expression and confirmation of the general estimate.

Mr. Matthew Arnold says, 'In the sure and flawless perfection of his rhythm and diction he is as admirable as Virgil and Dante, and in this respect he is unique amongst us. No one else in English literature and art possesses the like distinction.'

Macaulay says, 'In none of the works of Milton is his pecular manner more happily displayed than in the *Allegro* and the *Penseroso*. It is impossible to believe that the mechanism of language can be brought to a more exquisite degree of perfection.'

Dr. Garnett, in his recent *Life of Milton* in the *Great Writers* series, says of these poems, 'The limpidity of the diction is even more striking than its beauty. Never were ideas of such dignity embodied in verse so easy and familiar, and with such apparent absence of effort.'

Mr. Stopford Brooke remarks that, 'The greatest pains is bestowed on the rhythm. There is nothing hazarded, nothing careless, yet the poems move, it seems, with careless grace. They are a landmark in the metrical art of poetry, and are conscious of their art throughout.' This writer goes rather more into detail in speaking of the adaptation of the language to the subject. 'The words are arranged and chosen to imitate or suggest the thing described: alliteration is used to heighten the effect, but more sparingly than by the earlier men, such as his "original" Spenser. Throughout the *Allegro* the verse frequently rushes as if borne along by very joy; its character is swiftness and smoothness. Few, if any, pauses occur in the midst of the lines. Throughout the *Penseroso* the verse frequently pauses in the midst of the lines. It rests, like a pensive man who, walking, stops to think, and its movement is slow, even stately.'

Assuming then that the student's judgment is in general accordance with that embodied in these quotations, let us try to discover those elements of the poems that combine to produce such an effect. Here we would recommend that the student should use certain pages of his note-book for recording particulars of different kinds under separate headings, such as metre, rhyme, accentuation, alliteration, imagery, epithets, order of words, grammatical peculiarities, vocabulary, words archaic, uncommon, peculiar in use or origin. When any fact is observed or ascertained, let it be entered in its proper place under its appropriate heading, for the orderly classification of items of knowledge is a most important step towards making the knowledge more real as well as more readily available.

Referring to the ordinary annotations of Shakespeare and other authors for purposes of study and preparation for examination, Dr. Bain says one great drawback in such works is that nearly everything is memory work. Agreeing in the main with this opinion, we do not think it would apply in anything like the same degree to the kind of annotations we suggest, since the practice of observing and recording the observations would materially assist in co-ordinating, systematising, and rendering sound and permanent the knowledge gained.

With regard to metre the student will notice that each of the poems has an introduction of a different metrical character from the rest of the composition. The introduction in each case consists of ten lines of iambic trimeters and pentameters, that is of lines of three feet and five feet alternately, each foot as a rule consisting of an unaccented syllable followed by an unaccented one. The body of each poem is composed of tetrameters or lines of four feet; but while the *Allegro* contains many trochaic measures, or lines in which the accented syllable of each foot comes first, the *Penseroso* has comparatively few such measures. This accounts partly for the difference in the rate of movement of the two poems. The trochaic metre lends itself to rapid utterance, and can be easily spoken

in a light and tripping manner. The iambic metre is more steady in its flow, and adapts itself to stately speech, especially when broken by suitable pauses.

As examples of the tripping trochaic metre note the lines,

'Haste thee, Nymph, and bring, with thee
Jest, and youthful Jollity,
Quips and cranks and wanton wiles,
Nods and becks and wreathed smiles,' etc.

'Come and trip it as you go
On the light fantastic toe.'

And as examples of the slower iambic metre note the lines near the end of the *Penseroso*—

'And may at last my weary age,
Find out the peaceful hermitage,
The hairy gown and mossy cell,' etc.

Accentuation.—Under this head it may be remarked that in *Il Penseroso* line 39, *commercing* is accented on the second syllable, and in line 54, *contemplation* must be pronounced as having five syllables. Also in line 89, the word *spirit*, in accordance with old pronounciation, is treated as a monosyllable. In line 130, the sense as well as the rhythm requires *minute* to be accented on the first syllable. There are several words like *wreathèd*, *removèd*, *archèd*, *heavèd* which require the separate sounding of the syllable *ed*.

Rhyme:—In these two poems the rhymes are nearly all of perfect character; but it is worth noticing that in *L'Allegro* line 110, *fiend* is pronounced *fend*, (compare *friend*;) line 138 *pierce* rhymes with *verse*, as *perce*, (compare Percy from pierce-eye); and in *Il Penseroso*, 171, *shew* is pronounced *shoo* to rhyme with *dew* (compare the Sonnet on reaching his 23rd year where *shew'th* rhymes with *youth* and *truth*.

There are a few other rhymes of the kind commonly allowed though not quite perfect: as *tie, harmony; strove, above; throne, contemplation; mirth, hearth; Bear, unsphere; tragedy, by; wont, hunt; groves, loves; breathe, underneath; ecstacies, eyes.* Two or three of these are what Professor Bain calls 'eye-rhymes.'

Alliteration:—This ornament or device was in Anglo-Saxon and early English poetry the substitute for rhyme, and is sometimes called *head-rhyme*. When used very frequently in modern poetry it is apt to pall on the ear which is best pleased by variety; but it is remarkably effective when used with moderation and good judgment. The student should note the lines which illustrate this feature. Among the most striking are these

'Till the *d*appled *d*awn *d*oth rise,'
'To the *s*tack, or the barn-door,
*S*toutly *s*truts his dames before:'
'*W*arble his native *w*ood-notes *w*ild.'
'*L*ap me in soft *L*ydian airs;'
'*M*ost *m*usical, *m*ost *m*elancholy!'
'Where *m*ore is *m*eant than *m*eets the ear.'
'But *k*erchieft in a *c*omely *c*loud'

Perhaps the finest example is this in *Il Penseroso*,

'Over some wide-watered shore
*S*winging *s*low with *s*ullen roar.'

The points to which attention has been directed relate, for the most part, to what may be called the 'mechanism of poetry.' When we turn to consider the poet's choice of words we approach a subject more intimately connected with the substance of the poetry. 'Language,' as Mr. Wicksteed remarks in his lectures on Sociology, 'is the chief instrument by which is secured the continuity of thought and knowledge.' Words, known and understood, are points of contact between our own minds and the minds of the past as well as of the present generation. Thus the acquisition of additional words increases a man's mastery over the means of intellectual life. Mr. Mark Pattison observes 'Words, over and above their dictionary signification, connote all the feeling which has gathered round them by reason of their employment through a hundred generations of song.' 'Milton's diction is the elaborated outcome of all the best words of antecedent poetry, not by a process of recollected reading and storage, but by the same mental habit by which we learn to speak our mother tongue.' 'Milton's secret lies in his mastery over the rich treasure of this inherited vocabulary.'

We have placed these extracts before the student that he may the better understand how much the effect of a poem depends on the richness of the poet's vocabulary. Every attentive reader of *L'Allegro* and *It Penseroso* must have been struck by the remarkably varied vocabulary employed in them. By the process of counting the words in all Milton's poems it has been found that he uses as many as 8,000 words, while Shakespeare uses about 15,000. 'From this' says Mr. Pattison, 'it might be inferred that the Miltonic vocabulary is only half as rich as that of Shakespeare. But no inference can be founded on the absolute number of words used by any writer. We must know not the total of different words, but the *proportion* of different words to the whole of any writer's words. Now to furnish a list of 100 different words the English Bible requires 531 common (? consecutive) words, Shakespeare 164, Milton 135 only.'

If the student will take the trouble to make lists of the words in the two poems we are considering, the result will bear out the conclusion arrived at by attentive reading.

Among the words which enrich the poems are many of the kind called archaic, that is old-fashioned, belonging to a previous age, others are used with a peculiar signification which was either quite new at the time, or had almost passed out of currency; and others have a special grammatical relation which has ceased to be commonly recognised in modern speech. We have made some lists of these words, and suggest that the reader should pay special attention to their use. With regard to archaic words we may call to mind how Trench in his 'Study of Words,' points out that the preservation of these is a service for which we are especially indebted to the poets.

Archaic and peculiar words:—*Forlorn*, participle from A. S. *forleosen*; *yclept*, participle from A.-S. *clipian*, to call; *buxom*, connected with *bugan*, to bend, meaning first yielding, pliant, in Milton lively; *quips*, sharp turns of speech,—repartees, possibly corrupted from the Latin *quid pro quo*, possibly from *whip*; *cranks*, crooks or turns,—puns; *becks*, from signs with the hand, beckon; *dight*, dressed, decked from A.-S. *dihtan*; *pied*, variegated (compare *piebald*); *jocund*, merry, from *jucundus*; *rebecks*, a rebeck was a three-stringed fiddle played with a bow; *junkets*, a sort of cream cheese: the word is sometimes spelt *juncates*, from Ital *giunco*, a rush, rushes being used to serve up this dainty; *weeds*, garments, now used

of a widow's mourning dress; *bout*, a turn or twist from A.-S. *bugan*, not from Fr. *bout*, end; *bested*, help, from *stead*, place, (compare, to stand by); *commèrcing*, holding communion, now confined to trading; *plight*, strain, from the participle of *plait*, to interweave, not the same as *plight*, a duty or condition, which is now used chiefly for an unfortunate condition; *chauntress*, for songstress, from Fr. *chanter*, to sing; *trickt*, adorned; *frounced*, with hair frizzled or curled: originally *frounce* meant to wrinkle the brow. *Flounce* is a current representative of *frounce*; *kerchieft*, having the head covered, from Fr. *couvre-chef*, head-cover (compare curfew from *couvre feu*); *garish*, staring, from *gare*, a form of *gasen*, to gaze; *pale*, an enclosure (compare 'the English pale' in Ireland); *ebon*, black from ebony, a hard wood of a black colour. Coleridge in his Hymn to Mont Blanc uses the terms—'an ebon mass'; *debonair*, from Fr. *de bon aire*, of good air, of pleasant manners, courteous; *demure*, from *de* (*bons*) *meurs*, of good manners, modest, now deteriorated, meaning usually assuming modesty; *cynosure*, a centre of attention, from Greek *kunos oura*, dog's tail, a name applied to the stars in the Little Bear which contained the Pole star, by which ancient sailors had to steer their course, and upon which, therefore, their attention had to be set. *Influence*, a word derived from the science of Astrology. *Pensioners*, followers, train or retinue. *Starr'd* placed as a constellation among the stars. *Grain*, purple dye, from the fact that *grain*, applied first to a small seed, was afterwards applied to any small object, then to the small bodies of the cochineal insects from which dye was obtained, then to the dye itself, and then, because this was of a durable kind, to any dye in fast colours (compare the verb *ingrain*). *Stole* here used for a hood or scarf, from Latin *stola*, a robe. *Cypress*, connected with the word *crape*, Fr. *crêpe*, Old Fr. *crespe*, Latin *crispus*, curled. *Unsphere*, take out of its sphere in Heaven.

The student should note also the following peculiarities of meaning and grammatical use:—

Sager in line 17, *L'Allegro*, may mean 'who are sager,' that is wiser,—or 'more sagely,' that is more wisely.

Frolic (l. 18), used as an adjective, which it originally was, now only used as a noun and verb, with a later form of adjective *frolicsome*.

Unreprovèd (l. 40), means not deserving reproof.

Eglantine (l. 48), is another name for the sweet-briar mentioned in the preceding line, and is derived from the Fr. *aiguille*, a needle. From the epithet 'twisted,' however it has been thought that Milton referred to the honeysuckle.

Amber (l. 61). Noun used as adjective.

Straight (l. 69), for straightway, immediately.

Secure (l. 91), free from care, from Latin *se* for *sine*, without. Usually secure means safe, free from danger.

Sweat (l. 105). Past tense of verb, for which we use sweated.

Hath (l. 108). Milton never uses *has*.

Higher (l. 22, *Il P.*), from a higher place, more highly. Higher is here an adverb.

Chiefest (l. 51), apparently a double superlative; but 'chief' may be used for very important.

Yon (l. 52), an adverb for yonder. *Yon* is still used thus in the North of England, as Who goes *yon*?

Hist along (l. 55). *Hist* is a verb in the Imperative mood, meaning bring along silently. An interjection used as a verb.

Slow (l. 76), an adverb used for slowly.

Removèd (l. 78). Distant, like *remote*, Latin *remotus*.

Nightly (l. 84), pertaining to night, not occurring every night.

Forsook (l. 91), for forsaken.

Mansion (l. 92), abode, place to stay in; not in modern sense of a grand house.

Minute-drops (l. 130), drops falling minute by minute; a shower ending, the drops fall at intervals, (compare *minute-gun*).

His (l. 128), for *its*, which did not appear in the language till the end of the sixteenth century, and is not used by Milton in any of his earlier poems, and only three times in the whole of them. *His*, was the neuter possessive as well as the masculine.

High-embowèd (l. 157), vaulted, arched.

Another class of words calling for special notice is that of the compound words which Milton used with remarkable effect. Many of his compound epithets deserve the description Archbishop Trench gives them in 'English Past and Present'—'poems in miniature.' Macaulay uses a still stronger expression when, commenting upon these two poems, he says 'Every epithet is a text for a canto.' The finest example in these poems is, perhaps, that in *Il Penseroso*, line 146, '*dewy-feathered* Sleep' which may mean 'Sleep with dewy feathers,' feathers bedewed, or 'dewy and feathered Sleep.' There are many others which the student may collect and examine; and a little thought will prove not only how well chosen they are, but also what a world of meaning is suggested within the narrow limits of three or four syllables. These are some we have noted '*heart-easing* Mirth' (compare heart-rending); '*ivy-crownèd* Bacchus;' '*fresh-blown* roses,' that is roses freshly-blown, the adjective form being used for the abverb; '*smooth-shaven* green,' for grass closely mown,—'*bright-haired* Vesta,'—'*neat-handed* Phyllis,'—'*fiery-wheelèd* throne,'—'*wide-watered* shore,'—'*well-trod* stage,' that is stage where good actors perform in good plays, or where plays are frequently performed; '*civil-suited* morn,' that is a dull or cloudy morning, 'dressed in sober grey;' '*high-embowèd* roof' already explained.

The other epithets which are not compound words must not be overlooked, for many of them are no less expressive, for example:—'*frolic* winds,' '*ebon* shades,' '*wreathèd* smiles,' '*wrinkled* care,' that is care which causes wrinkles,—'*fantastic* toe' for the foot engaged in dancing; '*dappled* dawn,' '*secure* delight,' that is pleasure without a care,—'*chequered* shade,' from the sunlight falling through the boughs, compare Tennyson's '*netted* sunbeams' in '*The Brook*,'—'*shadowy* flail,' expressing the supernatural reference to the goblin's drudgery,—'*winding* bout,'—'*linkèd* sweetness,'—'*wanton* heed and *giddy* cunning,'—'*eating* cares,' compare Horace's *curas edaces*; '*golden* slumber,' for happy, or belonging to the gods. All the above are in *L'Allegro*, and an equal number could be found in *Il Penseroso*, but we content our-

selves with referring to a few—'*hovering* dreams' '*storr'd* Ethiop queen,'—'*pensive* Nun,' '*musing* gait' for the slow pacing of a person in deep thought,—'*rapt* soul,' that is enraptured,—'*retired* Leisure,' her *sweetest saddest* plight' referring to the song of the nightingale, compare Shelley's 'our sweetest songs are those that tell of saddest thought,' in *The Skylark; drowsy* charm,' '*buskined* stage' for the theatre where tragedies are enacted,—'*archèd* walks of *twilight* groves,'—'*monumental* oak,' for memorial oak, not, as some one suggests, because oak was much used for monuments in churches,—'*storied* windows,' for the windows of a cathedral, with pictures of scripture incidents,—'*mossy* cell.'

Such a list of aptly used epithets full of meaning surely justify Dr. Garnett's praise of Milton's 'condensed opulence.' Recalling the text of the Proverbs which says 'a word fitly spoken is like apples of gold in pictures of silver,' we are tempted to liken these poems to trees loaded with golden apples.

A word or two should be added on Milton's arrangement of his epithets. This will be found to exhibit great variety. One favourite form has the noun preceded and followed by an adjective—thus '*unreproved* pleasures *free*,' and '*native* woodnotes *wild*.' Another form has the order, adjective noun, noun adjective, as

'By hedgerow elms, on hillocks green,'
'*Russet* lawns and fallows *gray*,'
'*Shallow* brooks and rivers *wide*,'
'In *saffron* robe with taper *clear*.'

Again we have '*horrid* shapes, and shrieks, and sights *unholy*,'—'Goddess *fair* and *free*,'—'*heaped Elysian* flowers,'—and many other arrangements. These were probably adopted with the greatest care by the poet in order to secure that balance of measure, blending of sounds, and variety of order which constitute so much of the charm of good poetry.

The student should not omit to notice the many cases of transferred epithets where the adjective is applied not to the name of the person or thing but rather to some quality or connected part, for instance 'wrinkled Care,' 'his hairy strength,' that is 'his strong and hairy body,' 'the accustomed oak,' the oak where the nightingale is wont to sing, 'studious cloister's pale,' enclosure frequented by studious persons, 'weary age,' the thoughtful man himself weary when old.

Line 136 of *Il Penseroso* presents a striking example of the use of epithets:

'Where the *rude* axe with *heaved* stroke.'

Here *heaved*, uplifted, applies properly to axe, and *rude*, violent, to stroke. Such an interchange of epithets is called a chiasmus.

The adjectival forms *shrill* in line 56 of *L'Allegro*, and *blithe*, in line 65, need not be regarded as adverbial in use. They apply as adjectives to the agents, in the first to the hounds and horn, in the second to the milkmaid.

Here it may be well to notice two instances of the construction called *zeugma* (Gr. = yoke), 'in which two nouns or phrases are connected with one verb which really suits only one of them,' or two verbs with one noun.

In haste her bower she *leaves*
With Thestylis to bind the sheaves;
Or, if the earlier season lead,
To the tanned haycock in the mead.

'Leaves her bower' is properly followed by 'to bind,' but some other verb is required to be introduced in the last line, as 'she goes.' Another example occurs in *Il Penseroso*:

'Let my due feet never fail
To *walk* the studious cloister's pale
And *love* the high embowèd roof.'

'To walk' properly belongs to 'feet,' but to make 'love' suitable we must suppose 'me' to be substituted for 'feet,' and 'let *me* never fail to love the high embowèd roof.'

In *L'Allegro*, line 44, it is questionable whether 'to come' applies to the lark or to the cheerful man. If the former, it has been observed that it is scarcely true to nature: the lark is not a social bird. If the latter, as Professor Masson contends, the construction is peculiar.

Another difficult passage is found in *Il Penseroso*, lines 147 to 150. This may mean 'Let some mysterious dream wave to and fro at the wings of sleep, in airy stream, that is a succession of pictures.' If 'his wings' means the wings of the dream, 'at' appears to be redundant.

'Thus done the tales,' *L'Allegro*, line 115, is the absolute construction, as also is the line 'Thy rapt soul sitting in thine eyes' in the companion poem.

We must conclude this paper with a glance at the imagery employed in the poems. Quoting from Richter, Archbishop Trench says in his *Study of Words* 'All language is, in some sort, a collection of faded metaphors.' A poet's language consists, however, in large measure of fresh living metaphors. It may almost be said that metaphors and similar kinds of imagery form the life blood of poetry. To express the same thought differently, imagination can alone give life and power to poetry. The figure of speech which most abounds in *L'Allegro* and *Il Penseroso* is Personification, as the student will find if he notes the various instances of its occurrence. Thus the lark's song is said to '*startle the dull night*,' 'the hounds and horn rouse the *slumbering morn*,' the '*hamlets invite*.' In some passages the personification is so continuous as to be allegorical in its character, a form of poetry Milton has so aptly described in the line 'Where more is meant than meets the ear.' A good example is that where Mirth is represented as the offspring of Zephyr, the frolic wind, and Aurora the dawn, thus interpreted by Professor Masson, 'It is the early freshness of the summer morning that best produces cheerfulness.' Calm Peace, spare Fast, retired Leisure, Contemplation, mute Silence, the nightingale, the moon, are all personified in rapid succession. Separate direct metaphors are not so frequent, but the passage, 'And ever against eating cares,' down to

'Untwisting all the chains that tie
The hidden soul of harmony'

is highly metaphorical, and abounds in splendid imagery. Other examples are the line 'scatters the rear of darkness thin,' where the cock-crowing is represented as shattering the straggling rear of the night, as of a hostile army. Again the sun is 'robed in flames and amber light,' and the 'clouds decked in a thousand liveries' or coloured garments. As with metaphors so with similes, simple direct comparisons are not very numerous. There are, however, a few striking examples, such as the lines 'As ragged as thy locks,' and 'Such sights as youthful poets dream' in

L'Allegro; and the 'fancies fond' 'as thick and numberless as the gay motes that people the sunbeams, or likest hovering dreams,' and the passage in which the 'wandering moon' is compared to 'one that had been led astray,' in *Il Penseroso.*

Besides the figures already noticed we should call attention to remarkably fine images with added expression of hyperbole in the latter poem

> 'Looks commercing with the skies,
> Thy rapt soul sitting in thine eyes:
> There, held in holy passion still,
> *Forget thyself to marble.*'

and

> 'As may with sweetness, through mine ear,
> *Dissolve me into ecstasies,*
> *And bring all Heaven before mine eyes.*'

Other typical instances of figures of speech will be found in the fine oxymoron,

> 'With *wanton heed* and *giddy cunning,*'

where the nouns indicate the reality of the musician's carefulness, while the adjectives indicate the impression on the hearer that there is no sign of painstaking. The line recalls the saying '*Ars celare artem,*'—'the highest art is to conceal art.' Other examples of oxymoron are the expressions, 'darkness visible' (Paradise Lost), *bitter-sweet*, a *clever fool*, and perhaps the most striking one in modern English literature is Tennyson's description of Lancelot

> 'His honour rooted in dishonour stood
> And faith unfaithful kept him falsely true.'

—o—

Publications Reviewed.

The Royal England Readers: The United Kingdom. British History since the Union of the Crowns. For Standard VI.

The Empire: A Complete History of Britain and the British People. London: Thomas Nelson and Sons.

These two volumes complete another capital series of historical reading books. 'The United Kingdom' contains a course of more than sixty lessons written in a bright, simple, and direct style. These lessons narrate the events which bear upon social and political progress, as well as those which affect mainly the rulers of the nation. Children taught from this book can scarcely fail to feel an interest in their country's annals, for the matter is put before them in such a clear fashion that little trouble is required to understand the drift of the paragraphs. Among the useful aids to understanding may be noticed the clear, well-spaced type, the bold clarendon headings of the paragraphs, the lists of notes and meanings appended to each chapter, and the abundant and suitable illustrations. The portraits of the sovereigns and eminent men especially deserve praise. At the close of the volume we find genealogical tables, and a succinct chronological outline of the history of the United Kingdom from 1603 to 1887.

'The Empire' is practically a combination of the two preceding volumes of the series—England, and the United Kingdom. It has been adapted, however, to more advanced pupils by making some additions to the text, by grouping paragraphs and chapters so as to make the divisions less numerous, and by omitting the verbal explanations after the lessons. A geographical appendix supplies such information as may be found necessary respecting the places named. The work is very suitable for the use of pupil teachers and middle class schools. It is marked by all those excellent features of typography, illustration, and neat binding for which the publishers are so well known.

An Elementary Treatise on Light and Heat. Rev. F. W. Aveling, M.A., B.Sc. London: Relfe Bros.

This is said to be intended to supply the need of a text book embracing all the subjects required in light and heat in the Matriculation and Cambridge local examinations.

We have looked at every page of it and read much of it very carefully. We are quite unable to recommend it. There seems to be no evidence that the author is familiar with the apparatus he refers to. We miss the simple but sufficient and necessary directions which are the outcome of practical experience. Science needs to be studied at first hand. We want to deal with the phenomena themselves rather than with descriptions of them. A book which does not encourage observation and experiment is not an aid but an impediment to the study of physics.

The printing of the book is not good; occasionally as on page 89, it is bad; the diagrams are in many cases discreditable, one rarely sees such. Those on pages 168, 169, 171 and 172 ought never to have appeared.

We give a few details to support our unfavourable impression. A page is given to the Metric System, but there is no diagram to illustrate the relative length of an inch to a millimetre. Nor is any reference made to a most useful constant which every student of physics must learn by heart, viz., that 25·4 millimetres make one inch, a value true to two places of decimals.

A weight thermometer is one of the first things a student of heat should be taught to make and to use. He will hardly get the information he requires from the book before us, indeed he will almost certainly come to the conclusion that a weight thermometer is used to ascertain temperature.

It is of great importance that the relation between the pressure and temperature of a gas when the volume remains constant, and between the temperature and volume when the pressure remains constant, should be clearly understood. The illustration, as adapted from Stewart's book, is needlessly complex and unsatisfactory. There is no need to refer to the density at all. It is necessary to know the volume of the flask and of the tubes. The method of doing this is omitted.

Again, it is of great importance that a student should understand the method of finding the specific heat of a few simple substances like copper or lead. No easy, and at the same time trustworthy method of doing so is given, though space is taken up with a description and diagram of a Bunsen's Calorimeter, an instrument which not one student in twenty needs to see, much less use.

The Century Atlas. London: John Walker and Co.

After lingering over and carefully examining the pages of this handsome volume one cannot but be struck with the gigantic strides made in the geographer's art during the past decade or two. Put beside the miserable map-books of our youth this is in very truth a superb work, and withal marvellously cheap.

As regards mere production—engraving, colouring, paper, and binding—this Atlas must be pronounced perfect. It is a pleasure to the eye to dwell upon the 52 beautifully-coloured maps, all of which are new. But a matter of far greater importance is the fact that this Atlas has been prepared with exceptional care. Mr. Bartholomew's name is, in itself, a sure guarantee on that point. Moreover there is appended a 'Gazetteer of the World,' which describes no less than 35,000 places.

In a word this is the cheapest, most comprehensive and reliable School Atlas before the public.

Milton's L'Allegro, Il Penseroso, Arcades, Lycidas, Sonnets, &c. With Introduction and Notes. By W. Bell, M.A.

Milton's Comus. With Introduction and Notes. By William Bell, M.A. London: Macmillan and Co.

The series of English Classics now in course of publication by Messrs. Macmillan specially for use by students in India, is worthy of becoming well-known at home. The two volumes before us contain all the English poems written by Milton before the outbreak of the Civil War. The general introduction to the first gives a good account of Milton's early life, and his preparation for the task he afterwards undertook. The most striking characteristics of his genius are ably summed up, and the conclusions are supported by quotations from Professor Masson and Matthew Arnold. The text is well printed, with the lines numbered for reference. The notes are very far from being mere verbal explanations, etymologies, and references. Indeed they include everything a student could reasonably desire in the way of elucidation of the text, and at the same time are presented in so clear and distinct a fashion that they are likely to attract the reader instead of repelling him, as is done by the crowded pages of annotation in some editions of classical authors.

What we have said of the first of these books may equally be said of the second—the *Comus*. The text is preceded by an admirable introduction, which traces the origin, sources, and purposes of Milton's Masque, and narrates somewhat fully the history of the Masque as a form of literature. In the notes the editor, like a good teacher, gathers illustrative passages from all quarters. The works quoted include Milton's *History of Britain*, and other prose writings, Trench's *Past and Present*, Jowett's Translation of *Plato's Phædo*, Dowden's *Transcripts and Studies*, Butcher and Lang's recent Translation of the *Odyssey*, and many others. At the end of each volume is supplied an index of the words specially annotated. Mr. Bell has done his work as editor in a thoroughly efficient manner, and we can heartily recommend the books to students preparing any of these poems for examination.

Vanity Fair. By W. M. Thackeray. London: Smith, Elder and Co.

If good wine needs no bush surely this masterpiece of Thackeray's stands in no need of praise. Handy as to size, clearly printed, with illustrations by the author, it is, taken altogether, a really wonderful shilling's-worth. If there happen to be any of our younger readers who have never read 'Vanity Fair' we urge them to buy the book forthwith, and so become acquainted with this charming English classic.

Examination Papers in Book-keeping: Set at the Civil Service and other Exaninations, With Preliminary Exercises. Collected or written by J. T. Medhurst. A.K.C., M.S.S. London: George Bell and Sons.

This is a very extensive collection of examination papers for practice for students of book-keeping, especially those who are preparing for examinations. A dozen easy sets of transactions for journalising and posting in the ledger, are followed by upwards of forty miscellaneous papers of a more advanced kind, and these by more than thirty papers actually set at the examinations of the City of London College, the Society of Arts, and the Civil Service. They are sufficiently varied and sufficiently difficult to serve every purpose in testing the proficiency of candidates, and guiding them to a right view of what is expected of them. It must be understood that there are no solutions, nor helps to the working of the papers, which are tests only, and must be used in connection with a teacher's instruction or the study of a text-book.

The Century Arithmetics. Standards I.—IV. London: Blackie and Son.

Four little books of well-graduated examples, suitable for the Standards named, clearly printed, and in limp cloth backs.

Lessons in Elementary Physiographic Astronomy. By John Mills. London: Chapman and Hall, 1889.

Viewed as a work covering the astronomy required in an elementary course of physiography as understood by the examiners in the subject at South Kensington, this is one of the best we have seen. The most casual observer, however, acquainted with Professor Lockyer's little book, 'The Movements of the Earth,' could not fail to notice the similarity between it and the work before us. It is true that the work is practical—a model telescope is described, and the method of making a model sextant; but each of the instruments may be found fully and similarly described in a pamphlet containing demonstrations and practical work in Astronomical Physics at the Normal School of Science, sold by the Science and Art Department for the nominal price of threepence. Let not these remarks be misunderstood. Mr. Mills has produced a book that will compare favourably with any of its kind. It would, however, have been better if he had acknowledged the two works from which his own has been compiled.

The Science of Common Life. By J. A. Bower, F.C.S. London: Cassell and Co.

A small volume, written for the Young People's Section of the National Home Reading Union. It is intended also as an easy introduction to Physics and Chemistry. There are a large number of experiments described, some of them of a simple kind, which can be easily performed by young persons just taking an interest in common things. It would be a suitable book to put into the hand of a scholar of thirteen.

The Royal English Classics.

Milton: L'Allegro, Il Penseroso, Lycidas, On Christ's Nativity.

Goldsmith: The Traveller, The Deserted Village.

Cowper: The Task, Book I.

Macaulay: Lord Clive: Scenes from his life. London: T. Nelson & Sons.

In continuation of a new series, of which we recently noticed the first numbers, the publishers have issued these four booklets. The selection from Milton consists of the four of his early poems next in importance to the Masque of Comus. The selection from Macaulay includes the most striking portions of the historian's brilliant essay on Lord Clive.

The good judgment which appears in the choice of the works is equally conspicuous in the character of the notes. These are not so numerous nor so elaborate as to overweight the text they are intended to elucidate. Briefly and clearly expressed, they serve admirably to explain allusions, and are likely to be especially useful in regard to difficulties of construction.

A short biographical sketch of the author, with a chronological summary, is prefixed to each book.

We commend these little works as neat in appearance, handy in form, moderate in price and admirable in aim and execution.

Explanatory Notes on Shakespeare's Tempest. By Oliver Cooper. Manchester: John Heywood.

This little book appears to us a very crude production. Two or three pages of ill-written introduction discuss the origin and date of the play. The notes, which occupy the remaining twenty-four pages, are meagre, and yet in many cases quite superfluous, often giving mere synonyms for words in the text which should require no explanation to any child able to read the original. Thus

'*Hap*—happen,' '*Ope*—open.'
'*You have spoken truer*—You have spoken more truly.'
'*He will not mind me*—he will not notice me.'
'*All knit up*—all bound up.'
'*Required*—demanded.' '*Wrangle*—dispute.'
'*A loyal sir*—a loyal gentleman.'

In a few words of preface it is suggested that the matter contained in the notes 'will be found amply sufficient' 'as a guide to the study of Shakespeare, for the use of students preparing for public examinations.' Some of the guidance is worth more than that we have quoted, but nowhere do we find any help to the understanding of the spirit of the play, which should be the first and main object of studying it. The price affixed to this book is altogether out of proportion to its value.

Delecourt's French Instructor. London: John Heywood.

This book contains some eighty pages of easy French extracts and pieces of poetry with notes. Directions are also added for writing original pieces modelled on some of the extracts given. The last part of the book consists of an introduction to Commercial Correspondence, and extends over about forty pages. There is a French-English index of words at the end.

Synoptical Tables of Organic and Inorganic Chemistry. By Clement P. Leaper, F.C.S. London: George Gill and Sons.

These tables are drawn up for beginners in chemistry. They are intended to save them from the difficulty of distinguishing what is and what is not essential. Pupils are recommended by the author to commit these tables to memory. We are not prepared to say that these notes may not prove very useful, especially in regard to passing certain examinations. We have, however, a preference for original notes, and we have a decided objection to committing notes on an extensive scale to memory, whether they be original or not.

Bacon's Excelsior Combination Atlas. London: G. W. Bacon & Co.

This is the third of these combination Atlases which we have noticed. It is intended for Standard VI. and Third Year Pupil Teachers. Like the two former numbers, it is a cheap sixpennyworth. It contains five general maps and eleven memory maps.

WE have received from Mr. T. Fisher Unwin several recent numbers of the *Revue Bleue*, a well-known literary weekly published in Paris. In addition to articles on various subjects; art, musical, and dramatic notes, reviews, &c., each issue contains a serial from the pen of the distinguished writer M. André Theuriet, entitled *L'Oncle Scipion Maginot*. The matter is varied and readable, and should secure for the journal a moderate amount of English patronage.

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